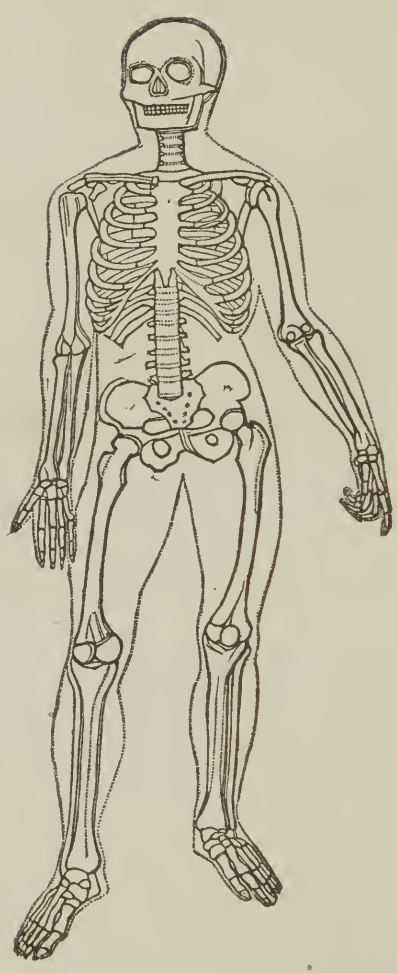

FIRST BOOK

ON

ANATOMY AND PHYSIOLOGY.

BY CALVIN CUTTER, M. D.

AUTHOR OF "ANATOMY AND PHYSIOLOGY FOR ACADEMIES," ETC.,
AND "PHYSIOLOGY FOR COMMON SCHOOLS."

WITH EIGHTY-FOUR ENGRAVINGS.

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PREFACE.

In presenting this work to the public, the author would indulge in a few prefatory suggestions.

Education, to be complete, must be not only moral and intellectual, but physical. As the culture of the mind and of the affections is the subject of systematic attention in early life, should not the education of the physical powers be commenced as early? It will demand no more maturity and thought to understand the reasons for adequate clothing, bathing, the necessity of an erect position in standing and sitting, regularity in taking food, the supply of pure air to the lungs, &c., than to comprehend geographical details or moral truths. Is not a knowledge of the laws and habits upon which health depends, as important to the development of a vigorous physical constitution, as moral instruction is to the formation of correct moral principles? Can any reason be given why both should not be taught in the school-room?

A child should be taught to call each organ by its correct name. No more effort is required to learn the meaning of a *proper*, than an improper term. For example: a child will pronounce the word as readily, and obtain as correct an idea, if you say *lungs*, as if you used the word *lights*.

In preparing this work, it has not been deemed necessary to use low, vulgar terms, for the purpose of being understood; but such words have been selected as good usage sanctions. Should the pupil meet with any word he does not understand,

let him consult his dictionary, as he should do in perusing works upon history, when a similar difficulty occurs.

It would be a profitable exercise for the pupil to draw the illustrating figure on a black-board or slate. This would impress the position of the organs on the mind.

With advanced pupils, it is recommended that the subject be examined in the form of *topics*.

In this work, the technical words interspersed with the text, have been divided into syllables, and the accented syllables designated. An ample Glossary of technical terms has also been appended to the work, to which reference should be made.

For a more full and complete explanation of Anatomy and Physiology, the pupil is referred to the author's Treatise, of 340 pages, for Academies, High Schools, and Families.

To the instructors of youth, and the patrons of education, this work is respectfully submitted.

Boston, *August*, 1847.

CONTENTS.

FIRST BOOK

ON

ANATOMY AND PHYSIOLOGY.

CHAPTER I.

GENERAL REMARKS.

1. Anatomy is a description of the *organs*, or parts of a body.

Examples. 1st. Flowers have roots, stems, and blossoms. These are their organs. 2d. The teeth, stomach, and heart, are some of the organs of the human body.

2. Physiology is a description of the *function*, or use of an organ.

Examples. 1st. The roots of flowers suck up water, to make them grow. This is their function. 2d. The stomach, in man, is one of the organs that prepare the food for his growth. This is its function.

3. Anatomy and Physiology are divided into two kinds, namely, *Animal* and *Vegetable*.

4. Animal Anatomy and Physiology are again divided into *Human* and *Comparative*.

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1. What is anatomy? Give examples. 2. What is physiology? Give examples. 3. How many kinds of anatomy and physiology are there? 4. How are animal anatomy and physiology divided?

5. Human Anatomy and Physiology describe the structure and functions of the organs of *man*.

6. Comparative Anatomy describes the structure of *other animals* than man.

Examples. As the different organs of the horse, the whale, the monkey, and the eagle.

7. Comparative Physiology describes the functions of the organs of these animals.

8. Vegetable Anatomy and Physiology describe the structure and functions of different parts of trees, shrubs, plants, and flowers.

9. All bodies in nature are divided into *Organic* and *Inorganic.* Organic bodies include animals and plants. Inorganic bodies include earths, metals, and other minerals.

10. All organized bodies have a limited period of life, and this period varies with every species. In some plants, the period is limited to a single summer, as many garden flowers; while some trees, as the olive, live many hundred years. Some animals live but a short time, while the elephant lives more than a century.

11. This period of life is shortened by disease; but disease is under the control of fixed laws — laws which we are capable of understanding and obeying. How important, then, is the study of physiology! For how can we expect to obey laws which we do not understand?

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5. What do human anatomy and physiology describe? 6. What does comparative anatomy describe? Give examples. 7. What does comparative physiology describe? 8. What do vegetable anatomy and physiology describe? 9. How are all bodies in nature divided? What bodies are called organic? What bodies are called inorganic? 10. Have all animals and plants a limited period of life? Does this period vary with different species of animals and plants? Give some examples. 11. How is life usually shortened? Is disease under the control of fixed laws? Why is the study of physiology important to every person?

CHAPTER II.

THE BONES.

12. The BONES are the frame of the body, having outside of them the muscles (flesh) and skin.

13. Their use is to support and protect other parts of the body, as the lungs, the liver, the brain, &c.

Illustration. The bones are to the body what the different pieces of timber are to a house — they not only give form and support to the building, but, like the bones, impart strength to the whole structure.

14. There are two hundred and eight * bones in the human body, beside the teeth.

15. These, for convenience, are divided into four parts: 1st. The bones of the HEAD. 2d. The bones of the TRUNK. 3d. The bones of the UPPER EXTREMITIES. 4th. The bones of the LOWER EXTREMITIES.

16. The bones of the head are divided into those of the *Skull*, *Ear*, and *Face*.

17. The bones of the skull are eight in number. These are joined together by ragged edges, called *sutures*.

* Some anatomists reckon more than this number, others less, for the reason that, at different periods of life, the number of pieces of which one bone is formed, varies. *Example.* The breast-bone, in infancy, has *eight* pieces; in youth, *three;* in old age, but *one*.

---

12. What are the bones? 13. What is their use? 14. How many bones in the human body? 15. How are they divided? Name them. 16. How are the bones of the head divided? 17. How many bones in the skull? How are the bones of the skull joined together?

18. The sutures stop, in a measure, the jars caused by external blows. Children should never strike each other upon the head, because the bones of the skull in them are softer than in adults.

Fig. 2.

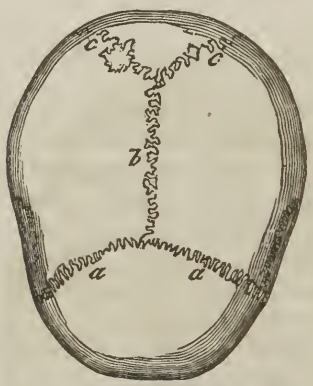

Fig. 2. The bones of the upper part of the skull. *a*, *a*, *b*, *c*, *c*, The sutures that join the bones.

19. There are four very small bones in each ear. They aid in hearing.

20. The number of bones in the face is fourteen.

21. The trunk has fifty-four bones — twenty-four *Ribs;* twenty-four bones in the *Spi'nal Col'umn*, (back-bone;) four in the *Pel'vis;* the *Ster'num*, (breast-bone;) and one at the root of the tongue.

22. All the Ribs are joined to the spinal column. There are twelve on each side.

---

18. What is the use of sutures? What does fig. 2 represent? 19. How many bones in each ear? What is their use? 20. How many bones in the face? 21. How many bones in the trunk? Name them. 22. To what are all the ribs joined? How many on each side?

23. The seven upper ribs are united in front to the sternum, by a yielding substance called *car'ti-lage*,* (gristle.) The remaining five are not attached, directly, to the sternum. Three are joined to each other by cartilage; two are not confined; hence they are called "floating ribs."

Fig. 3.

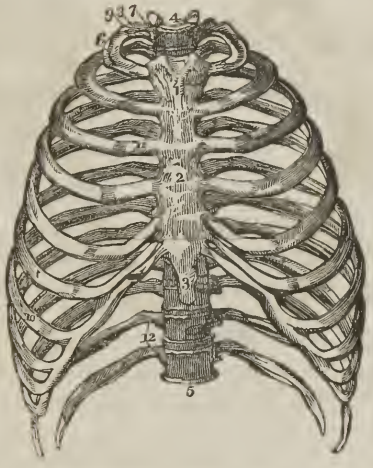

Fig. 3. 1, 2, 3, The sternum, (breast-bone.) 4, 5, The spinal column, (back-bone.) 6, 7, 8, 9, The first rib. 10, The seventh rib. 11, The cartilage of the third rib. 12, The floating ribs.

24. The cavity formed by the sternum, ribs, and spinal column, is called the *Chest*. It contains the heart, lungs, and large blood-vessels.

25. The shape of the chest is conical, or like a sugar-loaf.

* See paragraph 57.

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23. How are the first seven ribs united in front? The next three? What are the last two called? Why? Describe fig. 3. 24. How is the chest formed? What does it contain? 25. What is the shape of the chest?

26. The lower part of the chest is broader and fuller than the upper part, when it is not made smaller by tight clothing.

27. The SPINAL* COLUMN is composed of twenty-four pieces of bone. Each piece is called a *ver'te-bra.*

Fig. 4.

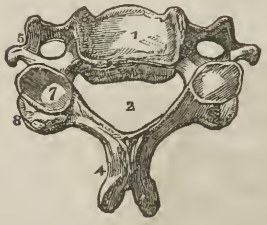

Fig. 5.

Fig. 4. The form of a vertebra of the neck. 1, The main portion of the bone. 2, The spinal canal, in which the spinal cord is placed. 4, 5, 7, 8, Points, or projections of the vertebra.

Fig. 5. 1, The cartilage that connects the vertebra. 3, 4, 5, 6, Points, or projections of the vertebra. 7, The spinal canal.

28. Between the vertebræ is a thick piece of cartilage, which is elastic, or springs like India-rubber. This not only unites the vertebræ, but permits them to move in different ways.

29. There is an opening in each vertebra. By a union of these openings, a canal is formed the whole length of the spinal column, in which the *spinal cord* (pith of the back-bone) is placed.

Observation. A good idea of the structure of the vertebræ

* From the Latin *spi'na*, a thorn; so called from the points of the vertebræ that are felt beneath the skin.

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26. How does the lower part of the chest compare in size with the upper? 27. Of how many pieces of bone is the spinal column composed? What is each piece called? Describe fig. 4. Describe fig. 5. 28. What is placed between the vertebræ? Give its use. 29. How is the spinal canal formed, and what does it contain? How may an idea of the structure of the vertebræ be obtained?

may be obtained by examining the spinal column of a domestic animal, as the hog, dog, or cat.

30. The spinal column is a very curious and perfect piece of mechanical art. By its structure, great strength and sufficient movement or flexibility are combined. The vertebræ are so firmly joined together, that dislocation of them, without fracture, is very rare.

Fig. 6.

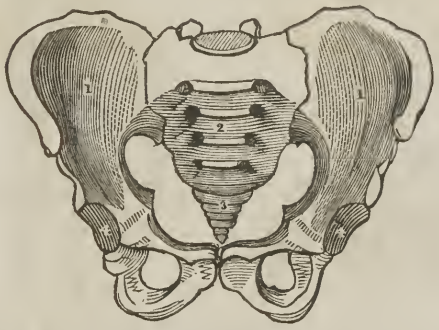

Fig. 6. 1, 1, The hip-bones. 2, The sacrum, upon which the spinal column rests. 3, The extremity of the back-bone, named the *coc'cyx*. 4, 4, The cavities for the head of the thigh-bone.

31. The PELVIS is composed of four bones. They are so arranged as to form a bony basin. The spinal column rests on these bones, and they also serve to support the lower extremities.

32. In the sides of these bones is a deep, round cavity, called *ac-e-tab'u-lum*, in which the head of the thigh-bone is placed.

33. There are sixty-four bones in the upper extremities — the *Scap'u-la*, (shoulder-blade;) the *Clav'i-cle*, (collar-bone;) and the bones of the arm, wrist, and hand.

---

30. What is said of the structure of the spinal column? Describe fig. 6. 31. Of how many bones is the pelvis composed? What is their use? 32. What is found in the sides of these bones? 33 Name the bones of the upper extremities.

34. The Scapula is a broad, irregular bone, situated upon the upper and back part of the chest.

35. The Clavicle is a thin bone at the base of the neck. It is joined at one extremity to the sternum, at the other to the scapula.

Fig. 7.

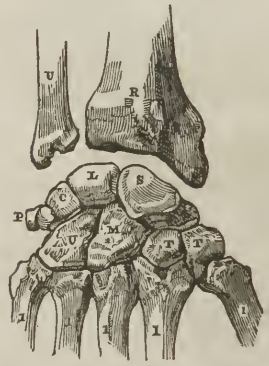

Fig. 8.

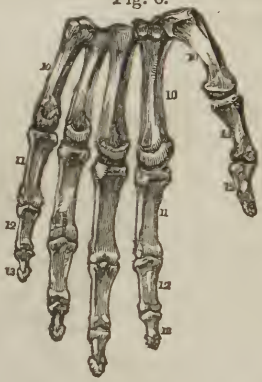

Fig. 7. U, The ulna. R, The radius. S, L, C, P, U, M, T, T, The eight bones of the wrist. 1, 1, 1, 1, 1, The five bones of the palm of the hand.

Fig. 8. 10, 10, 10, The bones of the palm of the hand. 11, 12, 13, The bones of the fingers. 14, 15, The bones of the thumb.

36. The use of the clavicle is to keep the arms from sliding towards the breast. Children should frequently throw their arms backward, as this exercise would tend to increase the length of this bone, and also to enlarge the chest.

37. The long, round bone of the arm, between the shoulder and elbow, is called the *hu'mer-us*.

38. The two bones between the elbow and wrist are called the *ra'di-us* and *ul'na*. By a beautiful arrangement of these bones, the hand is made to turn, or *rotate*, permitting its

34. Describe the scapula. 35. Where is the clavicle situated? Describe fig. 7. What does fig. 8 represent? 36. What is the use of the clavicle? 37. Describe the humerus. 38. What are the names of the bones between the elbow and wrist? What is said of the arrangement of these bones?

complicated and varied movements. Proofs of a designing Creator are nowhere more manifest than in the simple but wonderful structure and adaptation of the human hand.

39. The lower extremities contain sixty bones — the *Fe'mur*, (thigh-bone;) the *Pa-tel'la*, (knee-pan;) the *Tib'i-a*, (shin-bone;) the *Fib'u-la*, (small bone of the leg;) and the bones of the foot.

40. The FEMUR is the longest bone of the body. It supports the weight of the head, trunk, and upper extremities.

41. The TIBIA and the FIBULA are situated between the knee and ankle.

42. The foot is formed of twenty-six bones — seven in the instep, called *Tar'sal* bones; five *Met-a-tar'sal*, (the middle of the foot;) and fourteen toe-bones, called *Pha-lan'ges*.

43. The bones of the foot are so united as to give it the form of an arch, — convex on its upper surface, and concave on the lower surface. (See fig. 10.)

44. This structure gives to the foot the elasticity, or spring, which not only lessens the fatigue in walking, but prevents injury to the brain, heart, stomach, and other organs.

45. The bones are formed of both animal and earthy matter.

Experiment 1st. Take a bone and burn it in a clear fire a short time. On taking it out, it will look white, its weight will be found to be less, and it will break easily, because the fire has destroyed the *gel'a-tin*, (jelly;) or animal matter of the bone.

---

39. How many bones in the lower extremities? Name them. 40. Describe the femur. 41. What bones are situated between the knee and ankle? 42. How many bones in the foot? How many in the instep? How many in the middle of the foot? How many toe-bones? 43. What is the form of the foot? How does it appear on its upper surface? Upon its lower surface? 44. Of what utility is the arch of the foot? 45. Of what are the bones formed? How is it proved, by experiment 1st, that they contain earthy matter? How, by the 2d experiment, that they contain animal matter?

Experiment 2d. Take another bone, and immerse it in a weak acid, (one part of muriatic acid to six parts of water,) and let it remain a few days, and it can be knotted or easily cut without dulling the knife. In this experiment, the acid has removed the earthy matter, (carbonate and phosphate of lime,) while the gelatin remains.

Fig. 9.

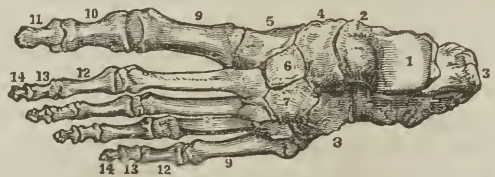

Fig. 9. The upper surface of the bones of the foot. 1, 2, 3, 4, 5, 6, 7, 8, The tarsal (instep) bones. 9, 9, The metatarsal bones. 10, 11, The bones of the great toe. 12, 13, 14, The bones of the small toes.

Fig. 10.

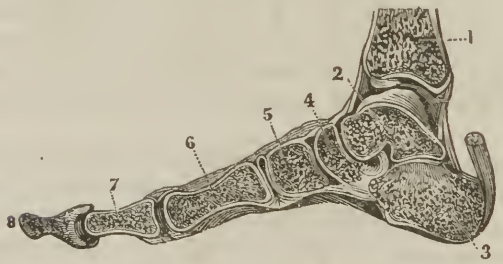

Fig. 10. A side view of the bones of the foot, showing its arched form. The arch rests upon the *heel* behind, and the *ball* of the toes in front. 1, The lower part of the tibia. 2, 3, 4, 5, Bones of the tarsus. 6, The metatarsal bone. 7, 8, The bones of the great toe. These bones are so united by cartilages as to secure a great degree of elasticity, or spring.

46. The bones of a child contain more of the animal than the earthy matter; therefore they will bend before they will break. The bones of the aged man will sooner break

46. Why do not a child's bones break as soon as an aged person's?

than bend, because they contain more of the earthy than animal matter.

Fig. 11.

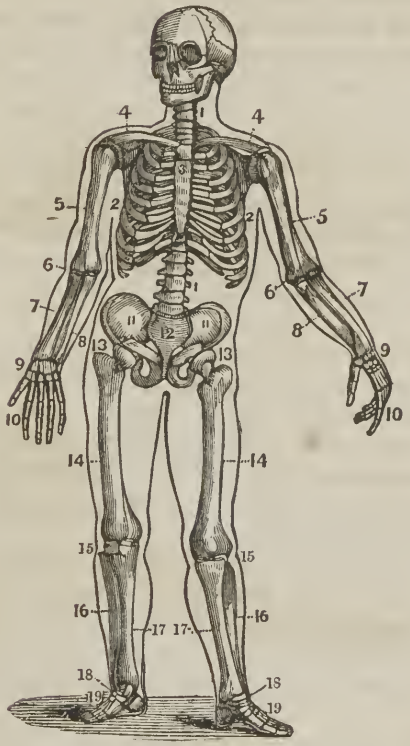

Fig. 11. 1, 1, The spinal column, on the top of which are the bones of the head. 2, 2, The ribs. 3, The sternum. 4, 4, The clavicle, (collar-bone.) 5, 5, The humerus, (upper arm-bone.) 6, 6, The elbow. 7, 7, The radius. 8, 8, The ulna. 9, 9, The carpus, (wrist-bones.) 10, 10, The phalanges, (finger-bones.) 11, 11, The pelvis. 12, The sacrum. 13, 13, The hip-joint. 14, 14, The femur, (thigh-bone.) 15, 15, The knee-joint. 16, 16, The fibula. 17, 17, The tibia, (shin-bone.) 18, 18, The ankle. 19, 19, The foot.

47. In middle age, the animal and the earthy matter exists in nearly the same proportions; hence the bones are fitted for labor, as they will not bend like the child's, nor fracture like those of the aged man.

48. The bones are covered with a firm *mem'brane*, or skin, called *per-i-os'te-um*. This membrane, like the bones, gives us but little pain if wounded when healthy; but if diseased, as in "felons," the pain is very severe.

PRACTICAL SUGGESTIONS.

49. The ribs and bones of the spinal column are soft and yielding in childhood. A small amount of pressure upon the ribs will cause them to injure the lungs, stomach, and heart. For this reason, every article of clothing should be loosely worn.

50. To prevent the bones of the spinal column becoming curved, every person should sit and stand erect. When a slight curvature of the spine exists, it can be improved by walking with a book, or a heavier weight, upon the top of the head; to balance which, the spine must be nearly erect. Those people that carry their burdens upon their heads seldom have crooked spines.

51. A person should not stand with one hip elevated more than the other. But, when necessary to throw the weight of the body upon one limb, keep that limb firm.

52. When a bone is fractured, the material that reunites it is deposited on the ends of the broken bone, by the blood-vessels.

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47. When are the bones best fitted for labor? 48. With what are the bones covered? What is diseased when we have "felons"? 49. Why should children wear loose clothing? 50. Give a prevention for a curved spine. When there is a slight curvature, how can it be improved? 51. Should persons stand with one hip elevated more than the other? What suggestion when the weight of the body is thrown upon one limb? 52. How is a broken bone healed?

53. Some days elapse, after the bone is broken, before the substance that reunites it is thrown out from the blood.

Fig. 12.

54. In young persons, it may be done during the second or third week, and in individuals advanced in life, it is usually done during the third and fourth week.

55. When the bone is uniting, during the second, third, or fourth week, the attention of a surgeon is more needed than during the first week. At that time, the ends of the bone should be placed together with accuracy. This requires the careful application of proper dressing.

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53. Is the reuniting substance thrown out immediately by the blood-vessels? 54. Does the time vary with different persons? 55. When is the surgeon's care most necessary?

CHAPTER III.

THE JOINTS.

56. The Joints are formed by the union of two or more bones. These are bound together by thin, glistening bands, called *lig'a-ments*.

57. The end of the bone that forms a joint, is covered with a tough, elastic substance, capable of bearing very great pressure, without causing pain.

Fig. 13.

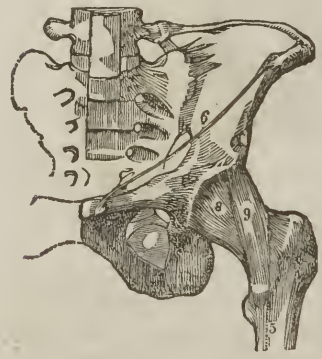

Fig. 14.

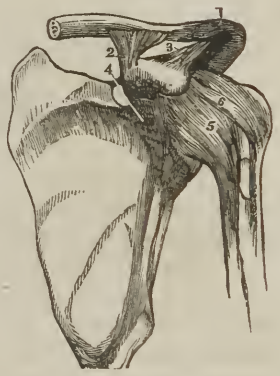

Fig. 13. 8, 9, The ligaments that extend from the hip-bone (6) to the thigh-bone, (5.)

Fig. 14. 2, 3, The ligaments that extend from the collar-bone (1) to the shoulder-blade, (4.) The ligaments 5, 6, extend from the shoulder-blade to the first bone of the arm.

---

56. How are the joints formed? What is shown by fig. 13? Describe fig. 14. 57. What is found at the end of a bone that forms a joint?

58. This substance is called *cartilage*. It diminishes the jar that the joints receive.

59. External to the cartilage is found a thin skin, or membrane. This passes from one bone to the other, and forms a closed sac. It contains a fluid called *Sy-no'vi-a*, (joint-water.)

60. This fluid is the oil of nature's own preparing. Its use is to diminish the friction which attends the movements of different parts that form the joint.

Observation. The joints of the domestic animals are similar in their construction to those of man. To illustrate this part of the body, a fresh joint of the calf or sheep may be used.

Fig. 15.

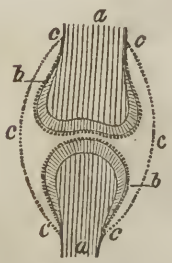

Fig. 16.

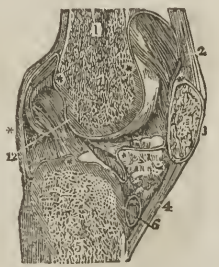

Fig. 15. The relative position of the bone, cartilage, and synovial membrane. *a, a,* The extremities of two bones, to form a joint. *b, b,* The cartilage that covers the end of the bone. *c, c, c, c, c, c,* The synovial membrane which covers the cartilage of both bones, and is then doubled back from one to the other; it is represented by the dotted lines.

Fig. 16. A vertical section of the knee-joint. 1, The thigh-bone. 3, The knee-pan. 5, The tibia. 2, 4, Ligaments of the knee-pan. 6, Cartilage of the tibia. 12, The cartilage of the thigh-bone. **** The synovial membrane.

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58. What is it called? Its use? 59. What is found external to the cartilage? What does it contain? 60. What is its use? What is represented by fig. 15? What is represented by fig. 16?

61. There are two kinds of joints, the *movable* and the *immovable.*

62. When the union of the bones permits them to move, the joint is called a *movable* joint; as the finger-joints.

63. When bones are united, to secure firmness, the joints are called *immovable* joints; as the sutures of the skull. (Fig. 2.)

64. The more movable a joint, the less firm it is, and the more frequently dislocated, or "put out." It is for this reason that the shoulder-joint is more frequently displaced than any other in the body.

65. Some joints move but in one direction, like a hinge of a door. These are called *Hinge Joints;* as the ankle and the knee-joint.

Fig. 17.

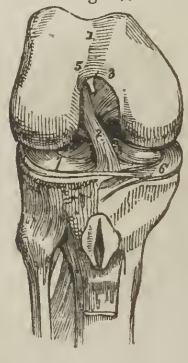

Fig. 18.

Fig. 17. 1, The lower extremity of the thigh-bone. 3, 5, The two rounded extremities that rest upon the upper extremity of the tibia, (shin-bone.) 2, Two ligaments within the knee-joint. 6, 7, The cartilage that tips the upper extremity of the shin-bone.

Fig. 18. 2, The deep socket of the hip-joint. 5, The round head of the thigh-bone, which is lodged in the socket. 3, The ligament within the socket.

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61. How many kinds of joints are there? 62. Define a movable joint. 63. Define an immovable joint. 64. Are the most movable joints the firmest? Why is the shoulder-joint more frequently displaced than any other in the body? 65. What are those joints called that move only in one direction? Give examples. Describe fig. 17. Describe fig. 18.

66. The union of the spinal column with the skull exhibits one of the most ingenious contrivances to be met with in the body. 1st. It permits the backward and forward movement, as in bowing and nodding the head. 2d. The motion which is made in turning the head from side to side.

67. This admirable piece of mechanism affords great protection to the spinal cord, at the top of the neck; this being, perhaps, the most vital portion of the whole body. Injury to it, or pressure upon it, is instantly fatal.

68. Some joints move in different directions, like a ball in a socket. These are called *Ball and Socket Joints;* as the shoulder and the hip-joint.

PRACTICAL SUGGESTIONS.

69. When a bone has been displaced, it should be carefully replaced, or "set;" and the injured joint should not be used until the swelling and pain begin to diminish. Then it may be rubbed and moved moderately.

70. A *sprained* joint should never be used, while the swelling and pain continue to increase, if a stiff, unyielding joint would be avoided.

71. The circulation of blood in the cartilage and ligaments of the joints is feeble, and is easily influenced by chills upon the skin. This causes pain and stiffness of the joint.

72. To prevent the chill, clothe the limbs with flannel. When a chill is contracted, immediately apply warm water, followed by vigorous rubbing.

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66. What is said of the union of the spinal column with the skull? 67. What is protected by this admirable piece of mechanism? 68. What are those joints called that move in different directions? Give examples. 69. How soon should an injured joint be used? 70. What is said of sprained joints? 71. What is said of the circulation of blood in the parts that form a joint? What is the effect of chill upon a joint? 72. How [illegible]?

CHAPTER IV.

THE MUSCLES.

73. A MUSCLE (lean flesh, or red meat) is composed of many little strings, called *fi'bres.*

74. Some of these fibres run in straight lines; others spread like a fan; while some are inclined like the feathery part of a quill.

Fig. 19.

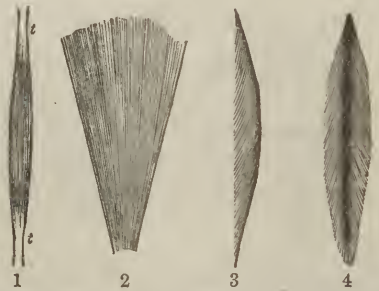

Fig. 19. 1, Represents the fibres of a muscle running in straight lines. 2, The fan-shaped fibres. 3, 4, Fibres inclined like the plumes of a quill. *t, t,* Tendons at the extremities of the muscle, 1.

75. Towards the extremities of a muscle the fibres unite, and form a substance of a whitish color, harder and tougher than the muscle. This is called *ten'don*, (cord, sinew.)

Observation. The pupil can examine a piece of boiled beef, or the leg of a fowl, and see the structure of the fibres and tendons of a muscle, with the attachment of the tendons to the bones.

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73. What is a muscle? 74. How do these fibres run? What is shown by fig. 19? 75. Describe a tendon.

76. Tendons have various shapes. Sometimes they are long, slender strings; sometimes they are short and thick; again, in some situations, they are thin and broad.

77. The use of tendons is to fasten the muscles to the bones, or to each other.

Illustration. The muscles and tendons are to the bones what the ropes are to the sails and yards of a ship. By their action, the direction of the sails and yards is changed. So, by the action of the muscles, the position of the bones of the body is changed.

78. There are more than four hundred muscles in the human body. To these, and a yellow substance called *fat*, that surrounds and fills the spaces in the muscles, the child and youth are indebted for the roundness and beauty of their limbs.

Observation. When we are sick, and cannot take food, the body is fed with this fat. The removal of it into the blood causes the sunken cheek, hollow eye, and prominent appearance of the bones after a severe sickness.

79. In some parts of the body, there is but one layer of muscle over the bones; in other parts, there are five or six layers, one muscle being placed over another.

80. In general, they form about the bones two layers, called the *superficial* or external muscles; and the *deep-seated*, or those nearest the bone.

81. When we look at this "harp of thousand strings," and notice the varied, rapid, complicated, yet accurate movements it performs in a single day, our thoughts are lost in

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76. What is the shape of tendons? 77. What is their use? Give an illustration. 78. How many muscles in the human body? Why are the limbs of a child more round and full than an aged person's? How is the body nourished when we cannot take food? What does the removal of it cause? 79. How many layers of muscle are there around the bones? 80. How many layers generally? What are they called?

wonder, in contemplating this superb and intricate machine, framed and finished by the divine Architect.

82. Every motion of the body is made by the *contracting* or shrinking of the fibres of the muscles; from the awkward movement of the boy's first effort at penmanship, to the delicate and graceful sweeps of the pianist; from the firm, stately tread of the soldier, to the light, fairy-like step of the *danseuse.*

83. Muscles remain contracted but a short time; then they relax, or lengthen, which is their rest. When the muscles are in a state of contraction, they are full, hard, and more prominent than when relaxed.

Fig. 20.

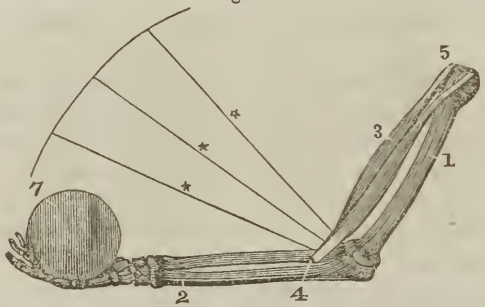

Fig. 20. 1, The bone of the arm above the elbow. 2, One of the bones below the elbow. 3, The muscle that bends the elbow. This muscle is united, by a tendon, to the bone below the elbow, (4;) at the other extremity, to the bone above the elbow, (5.) 7, A weight in the hand, to be raised. The central part of the muscle (3) contracts, and its two ends are brought nearer together. The bones below the elbow are brought to the lines shown by * * *. The weight is raised in the direction of the curved line. In this manner all the joints of the system are moved.

84. The eyebrows are elevated or raised by the contraction of the muscles on the forehead, 1, fig. 21.

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82. How is every motion of the body produced? 83. Do muscles remain contracted a long time? Describe fig. 20. [With figs. 21 and 22 before the pupil, let the uses of the different muscles be given, as explained by the twenty-three following paragraphs.]

85. The eyes are closed by the contraction of the muscles that surround them, 2, fig. 21.

86. The upper lip is elevated by the contraction of the muscles, 3, 4, 5, 6, fig. 21.

87. The mouth is closed by the contraction of a muscle that surrounds it, 7, fig. 21.

88. The lower lip is drawn down, or depressed, by the contraction of muscles on the lower part of the face, 8, fig. 21.

89. The head is bent forward, as in nodding, by the contraction of muscles on the front part of the neck, 9, fig. 21.

90. The chin is raised, and the head is brought erect by the contraction of muscles on the back part of the neck, 5, 6, fig. 22.

91. The body is bent forward, and the ribs brought down, by the contraction of muscles on the front and lower part of the trunk, 22, 23, fig. 21.

92. The muscles at the lower and back part of the trunk, keep the spinal column erect, 24, 25, 26, fig. 22.

93. The muscles upon the upper and front part of the chest, bring the shoulders forward, 11, fig. 21.

94. The shoulders are brought back by the contraction of the muscles upon the upper and back part of the chest, 7, fig. 22.

95. The arm is elevated by a muscle upon the shoulder, 10, fig. 21 ; and 8, fig. 22.

96. The arm is brought to the side by muscles, 11, fig. 21; and 24, fig. 22.

97. The elbow is bent by the contraction of the muscles on the upper and front side of the arm, 14, fig. 21.

98. The elbow is extended by a muscle on the back part of the arm, 10, fig. 22.

99. The wrist and fingers are bent by the muscles on the front part of the arm, below the elbow, 16, 18, fig. 21.

Fig. 21.

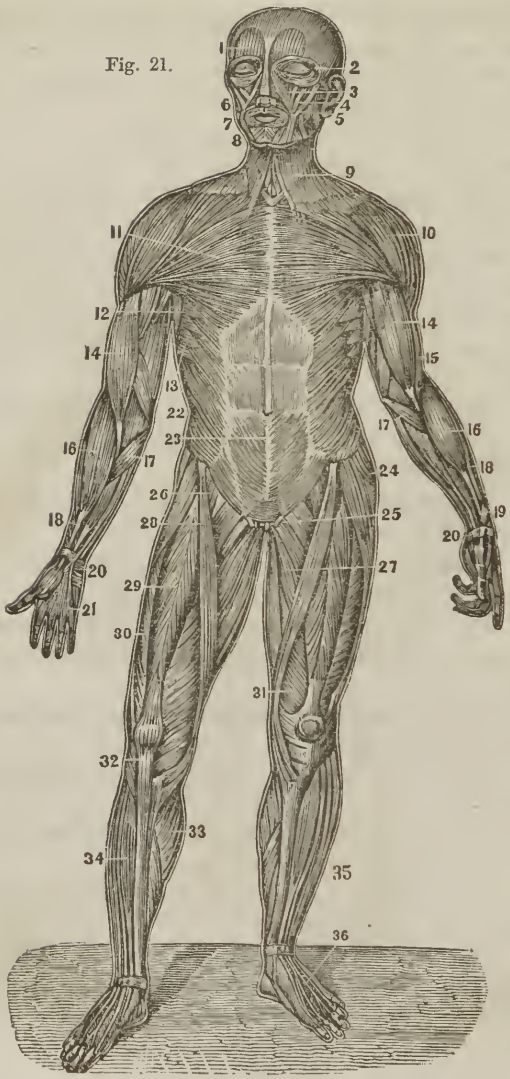
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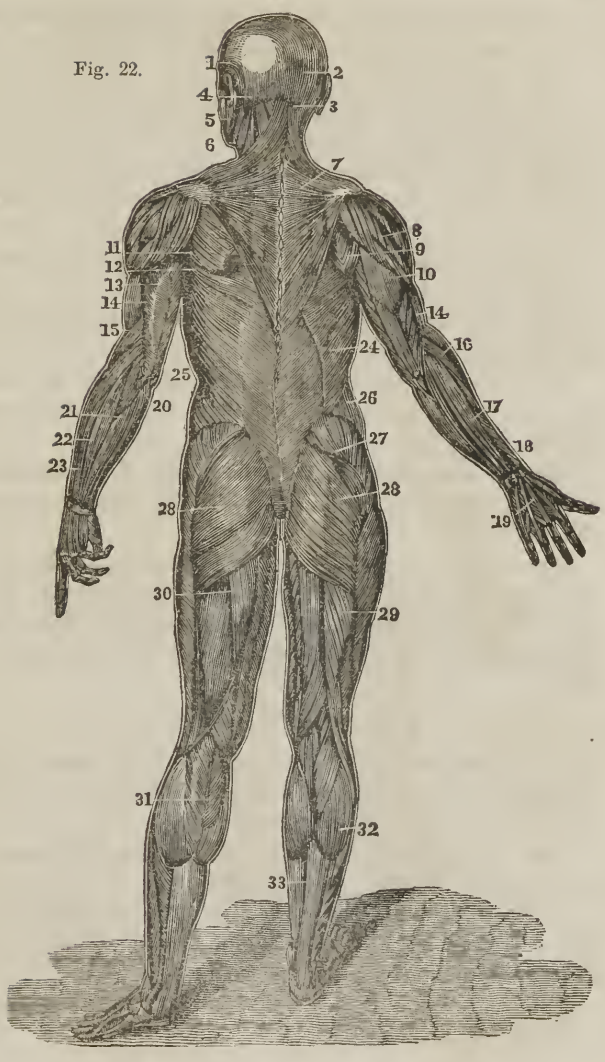
Fig. 22.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100. The muscles on the back part of the arm, below the elbow, extend the wrist and fingers, 21, 22, 23, fig. 22.

101. The muscles that bend the lower limbs, at the hip, are situated at the lower and front part of the trunk, and the upper and front part of the thigh, 25, 26, 27, 28, fig. 21.

102. The lower limbs are extended at the hips by the muscles on the lower and back part of the trunk, and the upper and back part of the thigh, 27, 28, fig. 22.

103. The muscles upon the front part of the thigh extend the leg at the knee, 29, 30, fig. 21.

104. The knee is bent by the muscles upon the back part of the thigh, 29, 30, fig. 22.

105. The muscles upon the fore part of the leg, below the knee, bend the foot at the ankle, and extend the toes, 34, 35, 36, fig. 21.

106. The muscles upon the back part of the leg, below the knee, extend the foot at the ankle, and bend the toes, 31, 32, 33, fig. 22.

Observation. It would be a profitable exercise for pupils to press their fingers upon prominent muscles, and at the same time, vigorously contract them, not only to learn their situations, but their use; as the one that bends the arm, 14, fig. 21.

PRACTICAL SUGGESTIONS.

107. *Every muscle should be used and then rested.* This will increase their size and strength, by increasing the flow of blood to the parts called into action.

108. A muscle should not be used too long, or remain at rest too long; both are alike injurious.

Illustrations. 1st. The blacksmith uses and rests the muscles of his arm when striking upon the anvil. They not only become large, but very firm and hard.

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107. Should muscles be used? Why? 108. Can muscles be used too long? Give illustrations.

2d. The student uses the muscles of the arm but little, in holding his books and pen; they not only become small, but soft.

3d. Let the student leave his books, and pound heated iron, and the muscles of his arm will increase in size and firmness. On the other hand, let the blacksmith assume the student's vocation, and the muscles of his arm will become soft and less firm.

109. *The muscles should be used in pure air.* The purer the air we breathe, the longer can the muscles be used in labor, walking, or sitting, without fatigue and injury; hence the benefit derived in thoroughly ventilating mechanics' shops.

110. If the air of the sick-room is pure, the patient will sit up longer than when the air is impure.

Observation. It is a common remark that a sick person will sit up longer when riding in a carriage, than in an easy chair in the room where they have lain sick. In the one instance, they breathe the pure air of heaven; in the other, usually, a confined, impure air.

111. *The muscles should be exercised in the light.* Light, particularly that of the sun, exercises as great an influence on man and the inferior animals as it does on plants. Both require the stimulus of this agent. Students should take their exercise during the day, rather than in the evening.

112. Shops occupied by mechanics, kitchens, and sitting-rooms, should be well lighted, and located on the sunny side of the house. Cellar kitchens and under-ground shops should be avoided.

Illustrations. Plants that grow in the shade, as under a

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109. Should the muscles be used in pure air? Why? 110. What is said of sick persons? Give an illustration. Why the difference? 111. Does the light exercise an influence upon the muscular system? When should students take exercise? 112. What suggestion relative to the situation of sitting-rooms, kitchens, and other rooms occupied during the day?

board, are of lighter color and more feeble than those that are exposed to the light of the sun. Persons that dwell in dark rooms are paler and less vigorous than those who inhabit apartments well lighted, and exposed to the rays of the sun.

113. *Every muscle should move freely.* Compression by any means, lessens the size and strength of the muscle.

Illustration. Let a surgeon bandage a limb for some weeks, when a bone is broken, and when the bandage is removed, the limb will be found smaller than when the accident occurred. The compression by close dresses produces similar effects upon the muscles of the body.

Fig. 23.

Fig. 23. An injurious position in sitting.

113. Should every muscle move freely? Why? Give an illustration. What effect have close dresses upon the muscles of the body? What does fig. 23 show?

114. In *speaking*, *reading*, *singing*, and *recitation*, the body and head should be erect. In this position, the parts called into action will be more under the control of the person, and can be used a longer time without fatigue, than in the position represented by fig. 23.

115. A person will stand longer, walk farther, and do more work when erect, than in a stooping posture; because the muscles of the back, in stooping, are in a state of tension, or stretching, to keep the head and trunk from falling forwards. In the erect position, the head and trunk are nicely balanced and supported by the bones of the spinal column, and the muscles of the back are called but slightly into action.

Fig. 24.

Fig. 24. The proper position in sitting.

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114. What should be the position of the body when we are speaking, reading, and reciting? Why? 115. Why will a person walk farther, and do more work, when erect than in a stooping posture? What is shown by fig. 24?

Experiment. Hold in each hand a pail of water, or equal weights, in a stooping posture, as long as it can be done without much suffering and injury. Again, when the muscular pain has ceased, hold the same pails of water, for the same length of time, in an erect posture, and note the difference in the fatigue of the muscles.

116. While studying, drawing, writing, and sewing, the body should be kept erect. Narrow chests, "hollow stomachs," "round shoulders," and ill health, follow a violation of this rule.

117. *The state of the mind affects muscular contraction.* A person who is cheerful and happy will do more work, and with less fatigue, than one who is peevish and unhappy.

118. When the muscular system has been in a state of rest, it should not *suddenly* be called into vigorous action. On arising from a bed, lounge, or chair, the first movements of the limbs should be slow, and then, if necessary, gradually increased.

Observation. If a man has a certain amount of work to be performed in nine hours, and his muscles have been in a state of rest, he will do it with less fatigue by performing half the amount of the labor in five hours, and the remainder in four hours.

119. The same principles should be regarded in driving horses and other beasts of burden.

120. When the muscles have been vigorously used, they should be *rested gradually.*

121. If a person has been making great muscular exertion in cutting wood, or any other employment, instead of

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Give an experiment. 116. What is one cause of narrow chests and round shoulders? 117. Does the state of the mind affect muscular contraction? 118. What caution is given in using the muscles when they have been some time in a state of rest? Give an observation. 119. Should this principle be observed in driving horses? 120. How should the muscles be rested when they have been called into vigorous action?

sitting down to rest, he should continue muscular action by some moderate labor.

122. When the skin is covered with perspiration from muscular action, avoid sitting down "to cool" in a current of air; rather put on more clothing, and continue to exercise moderately.

123. In cases when severe action of the muscles has been endured, bathing and rubbing the skin over the joints that have been used, are of much importance. By reducing to practice the foregoing suggestions, soreness of the muscles and stiffness of the joints will be prevented.

124. In jumping or falling from a carriage, or any height, the shock to the organs of the system may be obviated in the three following ways. 1st. Let the muscles be *relaxed*, not rigid. 2d. Let the limbs be bent at the ankle, knee, and hips; the head should be thrown slightly forward, with the trunk a little stooping. 3d. Fall upon the toes, not the heel.

Experiments. Stand with the trunk and lower limbs firm, and the muscles rigid; then jump a few inches perpendicularly to the floor, and fall upon the heels. Again, slightly bend the limbs, jump a few inches, and fall upon the toes, and the difference in the force of the shock, to the brain and other organs, will be readily noticed.

125. In walking, dancing, and learning to write, there will be less fatigue, and the movements will be more graceful, when the muscles are slightly relaxed, than when rigidly contracted. The same principle applies to most of the mechanical employments.

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122. When the skin is covered with perspiration from muscular action, how should it be "cooled"? 123. How can stiffness of the muscles be prevented? 124. In jumping from a carriage, in how many ways can the shock to the body be obviated? Give the 1st. Give the 2d. Give the 3d. Give experiments. 125. In what state should the muscles of the arm be when we are writing, or performing most employments?

Experiments. Attempt to bow with the muscles of the limbs and trunk rigid, and there will be a stiff bending of the body only at the hip-joint. On the other hand, attempt to bow with the muscles moderately relaxed; the ankle, the knee, and the hip-joint will slightly bend, producing an easy and graceful curve of the body.

126. When riding in cars and coaches, the system will not suffer so severely from the jar if the muscles are slightly relaxed. When riding over uneven places in roads, rising slightly upon the feet diminishes the shock occasioned by the sudden motion of the carriage. The muscles, under such circumstances, are to the body what elastic springs are to a carriage.

127. To render the action of the muscles complete and effective, they must be called into action repeatedly and at proper intervals. This education must be continued until not only each muscle, but every fibre of the muscle, is fully under the control of the will. In this way persons become expert penmen, dancers, singers, and skilful in every employment.

128. In training the muscles for effective action, it is very important that correct movements be adopted at the commencement. If this is neglected, much power and skill will be lost by acquiring improper and constrained movements.

Illustration. If a boy, while learning to mow, is allowed to swing his scythe in a stooping position, twisting his body at every sweep of the scythe, he will never become an easy, efficient mower. Proper instruction is as necessary in many of the agricultural branches as in the varied mechanical employments.

Give experiments. 126. What remark is given when riding in cars and coaches? 127. How is muscular action rendered complete and effective? How do persons become skilful in any employment? 128. What is necessary in the early education of the muscles? Give an illustration.

CHAPTER V.

THE TEETH.

129. The Teeth are firmly fixed in the sockets of the upper and lower jaw.

130. The first set, which appear in infancy, is called *tem'po-ra-ry*, or milk teeth. They are twenty in number; ten in each jaw.

Fig. 25.

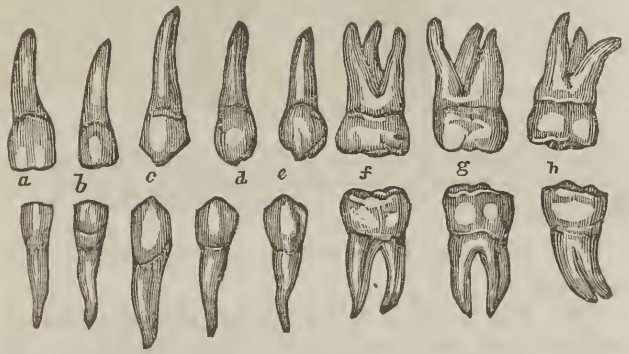

Fig. 25. The permanent teeth of the upper and lower jaw. *a*, *b*, The incisors. *c*, The cuspids. *d*, *e*, The bicuspids. *f*, *g*, The molars, (double teeth.) *h*, The wisdom teeth.

131. Between six and fourteen years of age, the temporary

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129. In what are the teeth placed? 130. What is the first set called? How many in number? Describe fig. 25. 131. When are these teeth removed?

teeth are removed, and the second set appears, called *per'manent* teeth. They number thirty-two, sixteen in each jaw.

132. The four front teeth in each jaw are called *in-ci'sors*, (cutting teeth;) the next tooth on each side, the *cus'pid* (eye tooth;) the next two, *bi-cus'pids*, (small grinders;) the next two, *mo'lars*, (grinders.) The last one on each side of the jaw is called a *wisdom tooth*, because it does not appear until a person is about twenty years old.

Fig. 26. Fig. 27.

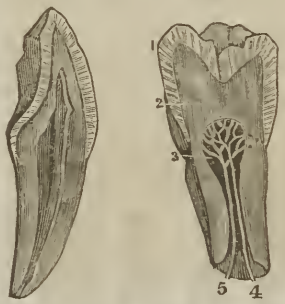

Fig. 26. A side view of the body and enamel of a front tooth.

Fig. 27. A side view of a molar tooth. 1, The enamel. 2, The body of the tooth. 3, The cavity in the crown of the tooth. 4, A nerve that spreads in the pulp of the tooth. 5, An artery that ramifies in the pulp of the tooth.

133. Each tooth is divided into two parts; namely, *crown* and *root*.

134. The crown is that part which protrudes from the jaw-bone and gum. The root, or "fang," is placed in the sockets of the jaw.

135. The incisors, cuspids, and bicuspids, have each but

What is the second set called? How many in each jaw? 132. What are the teeth in front called? The next? The next two? Those next the bicuspids? The last that appear in the jaw? Describe fig. 27. 133. How is each tooth divided? 134. Which part of the tooth is the crown? Which the root? 135. What teeth have each but one root?

one root. The molars of the upper jaw have three roots, while those of the lower jaw have but two. Fig. 25.

136. The crowns of the teeth are covered with a very hard substance, called *en-am'el.* The roots consist of bony matter.

137. Through the bony substance several small vessels pass, to aid in the growth and also in the removal of the tooth.

138. There are, beside these vessels, small white cords passing to each tooth, called *nerves.* (See fig 27.) When these nerves are diseased, we have the toothache.

Observation. It is not always necessary to have teeth extracted when they ache. The nerve may be diseased, and the tooth still be sound.

139. On the banks of the Genesee River there are many nicely-arranged mills for making flour. When the wheat is ground, a peculiar apparatus takes the ground kernels and separates the flour from the coarse part of the grain. But there is a more beautiful mill in the human system, that grinds the food; and then, by a peculiar apparatus in the body, the waste or innutritious part is separated from the nutritious portion. (See Chap. VI.)

140. The teeth are not only useful in chewing our food, but aid in speaking our words distinctly.

PRACTICAL SUGGESTIONS.

141. Care should be taken in childhood, that the milk teeth be removed as soon as they become loose, in order that

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What is the difference between the molars of the upper jaw and those of the lower jaw? 136. With what are the crowns of the teeth covered? Of what do the roots consist? 137. What is the use of the vessels that pass through the roots of the teeth? 138. What causes a tooth to ache? Give an observation. 140. Of what use are the teeth? 141. Why should the milk teeth be removed as soon as loose?

the second set of teeth may present a regular and beautiful appearance.

142. If the teeth are crowded and irregular, in consequence of the jaw being narrow and short, remove one or more, to prevent their looking unsightly and irregular. In a few months, the remaining teeth, with a little care, will fill the spaces.

143. When they press so hard upon each other as to injure the enamel, one or more should be removed.

144. To preserve the teeth, *they must be kept clean.* After eating food, they should be cleaned with a soft brush and water, or rubbed with a piece of soft flannel, to prevent the *tartar* collecting, and to remove the pieces of food that may have lodged between them.

145. It is well to use refined soap, once or twice every week, to remove any corroding substance that may exist around the teeth.

146. Food or drink should not be taken into the mouth when very *hot* or very *cold.* Sudden changes of temperature will crack the enamel, and, finally, produce decayed teeth.

Observation. When it is necessary to have decayed teeth filled, it is better for the health of the person and durability of the teeth to have them filled with *gold foil.*

147. Healthy persons have generally sound teeth, while feeble persons have decayed teeth. For this reason, we should try to learn and practise the few simple rules that give us health.

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142. What suggestion when the teeth are crowded and irregular? 143. When they press too hard upon the enamel? 144. How can the teeth be preserved? How often should they be cleaned? 145. What may be used once or twice a week to remove any corroding substance? 146 Why should we not drink hot drinks or eat hot food? Give an observation. 147. What is one reason for preserving good health?

CHAPTER VI.

THE DIGESTIVE ORGANS.

148. The Digestive Organs are those that change the food we eat, so that it may be passed into the blood-vessels.

149. These organs are the *Teeth*, *Sal'i-va-ry Glands*,* *Œ-soph'a-gus*, (gullet,) *Stom'ach*, *Liv'er*, *Pan'cre-as*, (sweetbread,) *small* and *large In-tes'tines*, (bowels,) *Lac'te-al Vessels*, and *Tho-rac'ic Duct*.

Fig. 28.

Fig. 28. 1, A gland behind the jaw and below the ear, (*pa-rot'id.*) 2, Its duct through which the saliva flows into the mouth. 3, A gland within the lower jaw, (*sub-max'il-la-ry.*) 4, Its duct. 5, A gland situated under the tongue, (*sub-lin'gual.*)

* See *Secretion.*

148. What is the use of the digestive organs? 149. Name them.

150. The first change in the food is made in the mouth, by the teeth, and the *sa-li'va* (spittle) from the salivary glands.

Observation. In the disease called "mumps," the parotid gland is affected; the sublingual gland is diseased in the swelling under the tongue, called the "frog."

151. The Œsophagus is a tube through which the food and drink pass into the stomach. It is situated behind the *tra'che-a,* (windpipe,) and in front of the upper part of the spinal column.

152. In swallowing, the food is pressed by the contraction of the muscles 5, 6, 7, into the *pha'rynx,* (the upper part of the gullet.) From the pharynx it is carried into the œsoph-

Fig. 29.

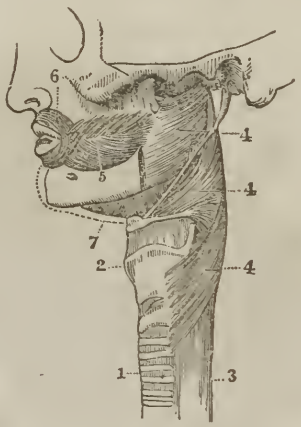

Fig. 29. A side view of the face, œsophagus, and trachea. 1, 2, The trachea (windpipe) and larynx. 3, The œsophagus. 4, 4, 4, The muscles of the upper portion of the œsophagus, forming the pharynx. 5, The muscles of the cheek. 6, The muscles that surround the mouth. 7, The muscle that forms the floor of the mouth.

150. Where is the first change in the food made? 151. What is the œsophagus? Where is it situated? What does fig. 29 represent? 152. Describe the parts that are called into action in swallowing food.

agus, by the contraction of the muscles 4, 4, 4, and through that tube into the stomach.

Observation. The process of swallowing, or deglutition, is easily observed, when a person passes either liquid or solid food into the stomach.

153. The Stomach is in the left side of the body, below the lungs and heart. (Fig. 46.) It is curved like a Scotch bag-pipe.

154. The coats or sides of the stomach are thin and yielding. On the inner side, there are many small glands, which secrete a fluid called *gas'tric juice.*

Fig. 30.

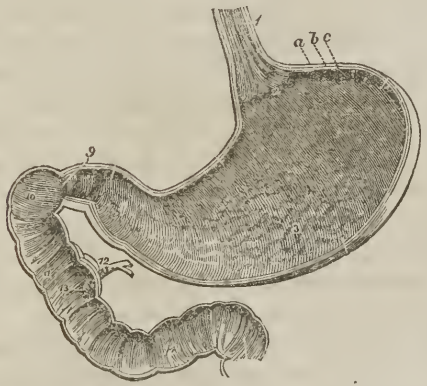

Fig. 30. The inner surface of the stomach and *du-o-de'num.* 1, The lower portion of the œsophagus. 2, The opening through which the food is passed into the stomach. 3, The stomach. 9, The opening through which the food passes out of the stomach into the duodenum, or upper portion of the intestines. 10, 11, 14, The duodenum. 12, 13, Ducts through which bile and pancreatic fluid pass into it. *a, b, c,* The three coats of the stomach; external, *se'rous;* middle, *mus'cu-lar;* inner, *mu'cous.*

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153. Where is the stomach situated? What does it resemble in shape? 154. What is said of the coats of the stomach? What is found on their inner surface? What does fig. 30 represent?

155. The DUODENUM (called by nurses the *second stomach*) is the most essential part of the small intestines. It is about twelve inches in length, and commences at the lower orifice of the stomach.

156. The LIVER is in the right side of the body, below the right lung. (Fig. 46.) From the liver there flows into the duodenum a yellow, bitter fluid, called *bile*, (gall.)

Observation. The bile does not flow into the healthy stomach. With many persons, the imagination is *bilious*, not the stomach.

157. The PANCREAS is situated behind and below the stomach. (Fig. 32.) From it there flows a fluid into the duodenum, called *pan-cre-at'ic* juice.

158. We will now notice another change in the food. The coats of the stomach contract, and the food is moved around, while, at the same time, the gastric juice mixes with it, forming a soft, pulpy substance, called *chyme.*

159. This pulpy, grayish substance is passed into the duodenum, and, by the action of the bile and pancreatic juice, it is changed into two parts; — a milk-like substance, called *chyle;* and *re-sid'u-um*, or waste matter.

160. The chyle and residuum pass from the duodenum into the remaining portion of the small intestines, and are moved along by a worm-like action of its parts.

161. As these two substances are moved along the intestines, the chyle is sucked up by minute vessels, that pass through the small intestines, and the residuum is carried into the large intestines.

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155. What is the first of the small intestines called? Where does it commence? 156. Where is the liver situated? What fluid flows from it? Give an observation. 157. Where is the pancreas? What fluid flows from it? 158. Where is the second change in the food effected? How is it done? 159. What becomes of this pulpy substance? What change is effected in the duodenum? 160. Where do the chyle and residuum then pass? 161. What becomes of the chyle? Of the residuum?

162. The minute vessels that pass through the intestines, are called *lacteal*, (milk-vessels.)

Fig. 31.

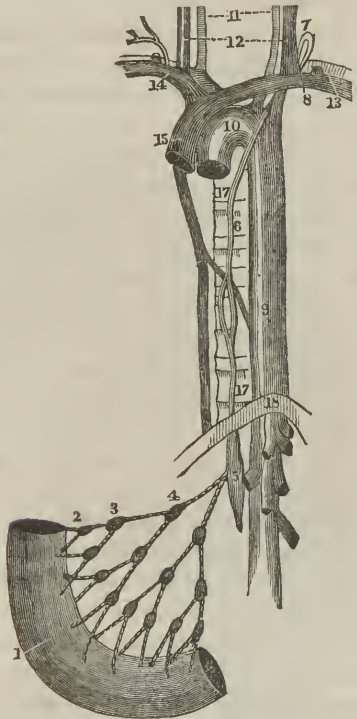

Fig. 31. A portion of the small intestines, lacteal vessels, mesenteric glands, and thoracic duct. 1, The intestine. 2, 3, 4, Mesenteric glands, through which the lacteals pass to the thoracic duct. 5, 6, The thoracic duct. 7, The point in the neck where it turns down to enter the vein at 8. 9, 10, The aorta. 11, 12, Vessels of the neck. 13, 14, 15, The large veins that convey the blood and chyle to the heart. 17, 17, The spinal column. 18, The diaphragm, (midriff.)

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162. What is the name of the minute vessels that pass through the intestines? Describe fig. 31.

163. The lacteals are very numerous, and each vessel passes through a small gland, called *mes-en-ter'ic.*

164. From the lacteals and mesenteric glands, the chyle is poured into the thoracic duct.

165. The THORACIC DUCT commences behind the liver, and ascends in front of the spinal column. At the lower part of the neck, it turns downward and forward, and pours its contents into the vein behind the collar-bone. (8, fig. 31.)

166. The COLON and RECTUM, or the divisions of the large intestines, are five or six feet in length, while the small intestines are about twenty-five feet in length. They carry the waste matter from the system.

Observation. A good idea of the liver and intestines can be obtained by examining these parts of a pig. In this animal, the sacs or pouches of the intestines are well defined.

167. Let the pupil, from fig. 32, give the following recapitulation of the changes that the food undergoes, before it is made into blood.

168. 1st. It is changed in the mouth, by the action of the teeth and saliva.

169. 2d. By the action of the stomach and gastric juice it is changed into a pulpy mass, called chyme.

170. 3d. In the duodenum, the bile and pancreatic juice change the chyme into chyle and residuum.

171. 4th. By the action of the lacteal vessels and thoracic duct, the chyle is poured into a vein behind the collar-bone, and passes through the heart to the lungs; here, by the action of the air, it becomes *blood.* (See Chap. VIII.)

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163. Are they numerous? Through what do they pass beside the coats of the intestines? 164. Where is the chyle poured from the lacteal vessels? 165. Where does the thoracic duct commence? Where does the chyle, or changed food, mix with the blood? 166. What is the length of the large intestines? Of the small intestines? 167. By the aid of fig. 32, recapitulate the changes that the food undergoes, from its introduction into the mouth until it enters the veins, to be mixed with the blood

Fig. 32.

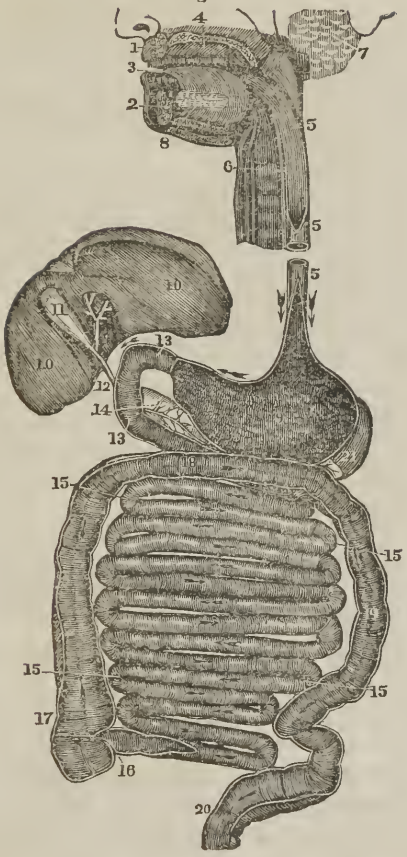

Fig. 32. A view of the organs of digestion, opened nearly the whole length. 1, The upper jaw. 2, The lower jaw. 3, The tongue. 4, The roof of the mouth. 5, 5, 5, The œsophagus. 6, The trachea. 7, The parotid gland. 8, The sublingual gland. 9, The stomach. 10, 10, The liver. 11, The gall cyst. 12, The duct that conveys the bile to the duodenum, (13, 13.) 14, The pancreas. 15, 15, 15, 15, The small intestine. 16, The opening of the small intestine into the large intestine. 17, 18, 19, 20, The large intestine. 21, The spleen.

PRACTICAL SUGGESTIONS.

172. There are three reasons for taking food. 1st. The child that is growing requires it, to promote the growth of the bones, muscles, skin, and other parts of the body; consequently, at that age, more food is needed than when the growth of the system has ceased.

173. 2d. Food is necessary to repair the waste which attends the functions of the different organs. The waste is greatest when we exercise most. For this reason, when a person changes from an active employment to one less active in character, the food should be diminished in nearly the same degree that the exercise is lessened.

Observations. When the girl leaves the active household employments for the shop of the dress-maker, — when the boy leaves the farm for the school-room, — the amount of food should be diminished as soon as the sedentary employment is commenced; for, under such circumstances, the appetite will not guide correctly.

174. 3d. The food aids in supporting the warmth of the body. This is the reason why the appetite for food is keener in the winter than in the summer. The system requires more food in cold than in hot weather.

Observations. 1st. Well-clothed children require less food in cold weather than those thinly clad. 2d. Flocks and herds that are sheltered in winter, will eat one third less than if exposed to the inclemency of the weather; hence it is true economy to keep the inferior animals warm, as well as children.

175. The coats of the stomach are distensible. This organ may contain two or three pints; or it will contract, and hold but a gill.

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172. What is the first reason for taking food? 173. The second? When is the waste greatest? When should the amount of food be lessened? Give observations. 174. What is the third reason? When does the body require the most food? 175. What is said of the distensible property of the stomach?

176. Food, to be suited to the wants of the system, should contain nutritious and innutritious matter — nutritious, to promote the growth and repair the waste of the system; and innutritious, to distend both the stomach and intestines.

Observation. Hot flour bread, rich pies, and jellies, are not so good articles for food, as the unbolted wheat bread, ripe fruits and berries.

177. Chyle of a more stimulating and nutritious character, is made from animal than from vegetable food. Therefore the former is more suitable to cold than to warm weather.

Observation. By abstaining from meats and stimulating drinks in warm weather, and living on a simple diet, the "season" or bowel complaints may be, in a great degree, prevented.

178. As the glands about the mouth supply a fluid to soften the food, it is not necessary to use drinks of any kind while eating. *After eating*, a small quantity may be taken without injury to the digestion of the food.

Observation. Were it customary not to place the drink on the table until the solid food was eaten, the evil arising from drinking too much at meals would be obviated.

179 The salivary glands, like the muscles, require to be used, and then rested; hence the chewing of "gum" and tobacco is highly injurious, because continued action of the glands exhausts their power, not to mention the narcotic effects of tobacco upon the body.

180. Food ought to be chewed slowly, in order that the saliva may become well mixed with it, before entering the second stage of digestion.

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176. What should the different articles of food contain? The use of the nutritious matter? Of the innutritious? Give an observation. 177. From what kind of food is the most stimulating chyle made? Which is best adapted to warm weather? 178. What is the function of the glands about the mouth? When may a small quantity of drink be taken and not injure digestion? 179. Why is it injurious to chew gum and tobacco? 180. Why should the food be chewed slowly?

181. The stomach has more strength to digest food when the system is not exhausted. Therefore severe exercise immediately before and after eating should be avoided.

182. In all instances, when the system is much exhausted, but little food, and that of a simple character, should be taken; as in this condition the strength of the stomach is diminished as much as that of the system.

183. Food should not be eaten immediately before retiring for sleep, as it will remain in the stomach an undue length of time, causing irritation of the body and disturbed sleep.

184. The effect of thus violating a law of health may be illustrated by an anecdote. A healthy farmer, who was in the habit of eating one fourth of a mince pie immediately before going to bed, became annoyed with unpleasant dreams, and, among the varied images of his fancy, he saw that of his deceased father. Becoming alarmed, he consulted a physician, who, after a patient hearing of the case, gravely advised him to eat *half* of a mince pie, assuring him that he would then see his grandfather.

185. If a person breathes pure air, the appetite will be keener, and the digestive organs more vigorous, than when impure air is inhaled. In the one case, the stomach is stimulated by pure blood, and in the other by impure blood. (See Chap. VIII.)

Illustrations. 1st. Dr. Reid, in his work on "Ventilation of Rooms," relates that an inn-keeper in London, when he provided a public dinner, always spread his tables in an underground room, with low walls. He assigned as a reason for so doing, that his guests consumed only one third as much food and wine as if the tables were laid in the open air.

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181. Why should we not exercise severely immediately before or after eating? 182. When the system is exhausted, how much food should be taken, and what kind? 183. Why should not food be eaten immediately before retiring for sleep? 184. Illustrate the ill effect of thus taking food by an anecdote. 185. Has pure air any effect on digestion? Give an illustration by Dr. Reid.

2d. A manufacturer stated before a committee of the British parliament, that he removed an arrangement for ventilating his mill, because he noticed that his men ate much more after his mill was ventilated, than previous to admitting fresh air into the rooms, and that he could not *afford* to have them breathe pure air.

186. The food, unless changed, (as described in paragraphs 168, 169, 170, 171,) does not strengthen the body. When disease prevents this change, no food should be eaten. This rule should be regarded with infants as well as adults.

187. When a person has been deprived of food for a considerable length of time, — as in the instance of a shipwrecked mariner, or a person recovering from fever, — the food, at first, should be very simple, taken in small quantities, and eaten at regular hours. The weaker the person, the more important to observe these remarks.

188. Water and most fluids are removed from the stomach in a very few minutes, by the action of the veins. In instances of great feebleness, the body can be strengthened sooner by liquid than by solid food.

189. When travelling in coaches or cars, the stomach is not in a state to digest large quantities of food. When food is taken, it should be of the simplest character, and small in quantity.

190. To prevent disease of the intestines and of the body, it is just as necessary that they be evacuated regularly, as that we take food into the stomach at regular periods.

191. Sitting, standing, and walking erect, aid in keeping the digestive organs healthy.

Another by a British manufacturer. 186. When should no food be eaten? By whom should this rule be observed? 187. When a person has been without food for several days, as a shipwrecked mariner, how should it be given? 188. Which are introduced into the system soonest, fluids or solid food? 189. What is said in regard to food while we are travelling? 191. What position of the body aids digestion?

CHAPTER VII.

THE HEART AND ITS VESSELS.

192. The blood is a fluid that passes through tubes, or vessels, to every part of the body. These vessels are called *veins*, *ar'te-ries*, and *cap'il-la-ries*.

193. The central organ of this circulating fluid is the Heart. It is situated in the chest, between the right and left lung. (Fig. 46.)

194. The heart is a double organ, or has two sides; called *right* and *left*.

195. Each side of the heart has two cavities. The upper cavity is called the *au'ri-cle*, (deaf ear.) The lower cavity is called the *ven'tri-cle*.

196. The auricles and ventricles are separated from each other by folds of membrane, called *valves*.

197. Between the auricle and ventricle of the right side of the heart, there are three valves.

198. Between the auricle and ventricle of the left side of the heart, there are two valves.

Observation. To obtain a clear idea of the heart and its valves, it is recommended to examine this part of an ox or calf.

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192. What is the blood? Name the vessels that carry the blood to different parts of the body. 193. What is the central organ of this circulating fluid? Where is it situated? 194. How many sides has the heart? 195. How many cavities has it? What is the upper cavity called? What is the lower cavity called? 196. How are these cavities separated? 197. How many valves between the right auricle and ventricle? 198. How many valves between the left auricle and ventricle?

199. The valves in the heart permit the blood to flow from the auricles to the ventricles, but prevent its reflowing.

200. The valves at the commencement of the aorta and pulmonary artery, permit the blood to flow from the ventricles into these vessels, but prevent its returning.

Fig. 33.

Fig. 34.

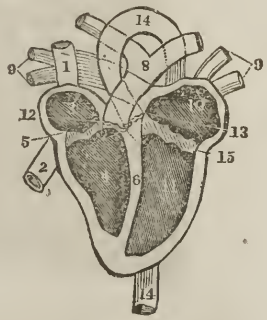

Fig. 33. 1, The right auricle of the heart. 2, The left auricle. 3, The right ventricle. 4. The left ventricle. 5, 6, 7, 8, 9, 10, Vessels * through which the blood passes to and from the heart.

Fig. 34. A view of the heart with its cavities and the vessels in connection with them. 1, 2, Vessels that carry the blood to the heart. 3, The right auricle. 4, The right ventricle. 5, The valves between the right auricle and ventricle. 6, The partition between the two ventricles. 8, The vessel that carries the blood to the lungs. 9, 9, The vessels that carry the blood to the left auricle, (10.) 11, The left ventricle. 15, The valves between the left auricle and ventricle. 12, 13, Valves at the commencement of the aorta and pulmonary artery. 14, The aorta.

Illustration. The valves of the heart, in their use, are similar to those of a pump, or steam engine.

201. The blood passes from the right auricle (3, fig. 34) into the right ventricle, (4;) from the right ventricle into the pulmonary artery, (8,) through which it passes to the lungs.

* All vessels that carry blood *to* the heart, are called *veins*. All vessels that carry blood *from* the heart, are called *arteries*.

199. What is the use of the valves of the heart? 200. What is the use of the valves at the commencement of the aorta and pulmonary artery? What is shown by fig. 33? Describe fig. 34. Give illustration. 201. Describe the circulation of the blood through the right side of the heart.

Fig. 35.

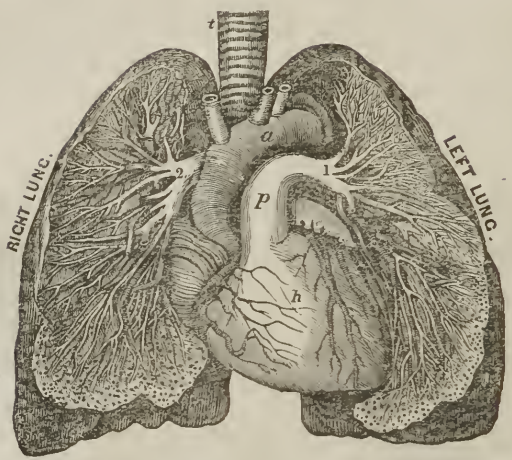

Fig. 35. *t*, The windpipe. *h*, The heart. *a*, The aorta. *p*, The pulmonary artery. 1, The branch of the pulmonary artery that divides in the left lung. 2, The branch that divides in the right lung.

The divisions of this artery continue to divide and subdivide, until they become no larger than hairs in size. Hence they are called *capillary* vessels. These minute vessels pass over the air-cells in the lungs, represented by small dark points around the margin of the lungs.

202. The blood, while passing over the air-cells (fig. 49) in the minute divisions of the pulmonary artery, is changed from a bluish color to a bright red. (Fig. 50.) It is then returned to the left side of the heart by the pulmonary veins, (9, 9, fig. 34.)

203. The left auricle, (10, fig. 34,) by its contraction, forces the blood into the left ventricle, (11.) The valves (15) prevent its reflowing. From the left ventricle the blood is forced into the aorta, (14.) The valves (13) prevent its returning.

Explain fig. 35. How are the capillaries of the lungs formed? 202. Where does the blood change its color? What vessels convey it to the left side of the heart? 203. Describe the circulation of blood through the left side of the heart.

Fig. 36.

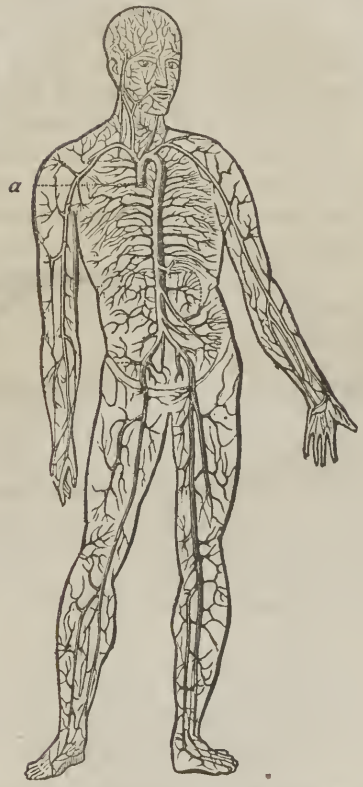

Fig. 36. The aorta and its branches. *a*, The commencement of the aorta.

204. The aorta divides and subdivides, until its minute branches are spread over every part of the body, in the same manner as the pulmonary artery is spread through every portion of the lungs.

What does fig. 36 represent? 204. What is said of the aorta?

205. The difference between the functions of these two vessels is this: one connects with the right ventricle of the heart, and distributes impure blood only to the lungs; the other connects with the left ventricle of the heart, and distributes pure blood to the whole body, the lungs not excepted.

206. At the extremity of the divisions of the aorta, as well as the pulmonary artery, are found capillary vessels. This curious net-work of vessels connects with the minute veins of the body, which return the impure blood to the heart

Fig. 37.

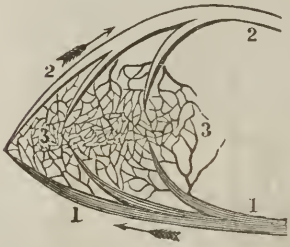

Fig. 38.

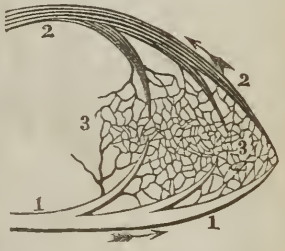

Fig. 37. 1, 1, A branch of the artery that carries the impure blood to the lungs. 3, 3, Capillary vessels. 2, 2, A vein through which red blood is returned to the left side of the heart.

Fig. 38. 1, 1, A branch of the aorta. This terminates in the capillaries, (3, 3.) 2, 2, A vein through which the impure blood is carried to the right side of the heart.

207. In fig. 37, the artery contains impure, dark-colored blood; it becomes red blood in the capillaries of the lungs, and is returned in the veins to the left side of the heart. This is called *pul-mon'ic*, or the circulation of blood in the lungs.

208. In fig. 38, the artery contains red blood; it becomes dark-colored in the capillaries, and is returned in the veins to the right side of the heart. This is called *sys-tem'ic*, or general circulation.

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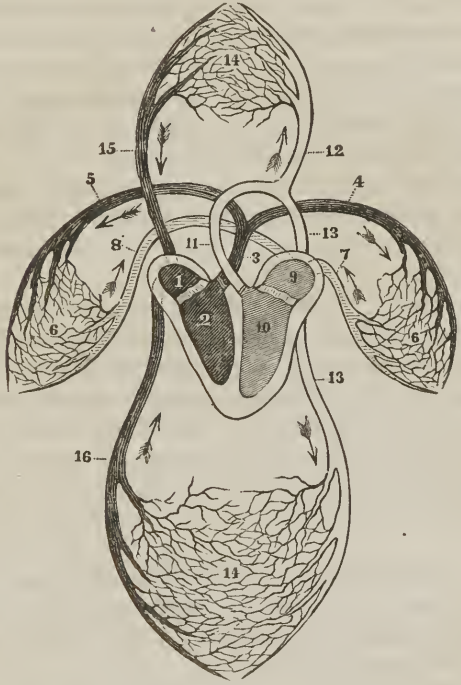
205. What difference in the functions of the aorta and pulmonary artery? 206. Where are the capillary vessels found? What is represented by fig. 37? By fig. 38? 207. What blood flows in the arteries in pulmonic circulation? 208. In the general circulation of the system?

209. The blood is carried to and from the heart by the agency of the *arteries*, *veins*, and *capillaries*. These vessels are found in every part of the system. They are necessary to the proper distribution of the blood. The relation of these vessels and the heart will be easily comprehended by examining fig. 39, which gives an ideal view of the circulatory system.

Fig. 39.



210. From the right ventricle of the heart, (2, fig. 39,) the dark, impure blood is forced into the pulmonary artery,

209. Are arteries, veins, and capillary vessels found in every part of the system? 210. Explain the circulation of blood in the lungs and general system, by aid of fig. 39.

(3;) and its branches (4, 5) carry the blood to the left and right lung. In the capillary vessels (6, 6) of the lungs, the blood becomes pure, or of a red color, and is returned to the left auricle of the heart, (9,) by the veins, (7, 8.) From the left auricle the pure blood passes into the left ventricle, (10.) By a forcible contraction of the left ventricle of the heart, the blood is thrown into the aorta, (11.) Its branches (12, 13, 13) carry the pure blood to every organ or part of the body. The divisions and subdivisions of the aorta terminate in capillary vessels, represented by 14, 14. In these hair-like vessels the blood becomes dark colored, and is returned to the right auricle of the heart, (1,) by the *ve'na ca'va descen'dens* (15) and *ve'na ca'va as-cen'dens*, (16.)

211. The heart aids in forcing the blood through the arteries, to the different parts of the body. Every time the heart contracts, there is a "pulse," or "pulsation," in the arteries.

Experiment. Apply the fingers upon the artery at the wrist, at two different points, about two inches apart; if the pressure be moderately made, the "pulse" will be felt at both points. Let the upper point be pressed firmly, and there will be no pulsation at the lower point; but make strong pressure upon the lower point only, and the pulsation will continue at the upper point; proving that the blood flows from the heart, in the arteries, to different parts of the system.

212. The heart contracts, or the pulse beats, about seventy-five times every minute, in adults; in infants, more than a hundred times every minute; in old persons, less than seventy-five times every minute.

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211. What causes the "pulse," or "pulsation," in the arteries? How is it proved that the blood flows from the heart in the arteries? 212. How often does the heart contract in adults? In infants? In aged persons?

213. There is no pulsation in the veins, and the return of the blood to the heart through them can be shown by the following experiments.

Experiments. 1st. Press firmly on one of the veins upon the back of the hand, carrying the pressure towards the fingers; for a moment the vein will disappear. On removing the pressure of the finger, it will reappear, from the blood rushing in from below.

2d. If a tape be tied around the arm above the elbow, the veins below will become larger and more prominent, and also a greater number will be brought in view. At this time, apply the finger at the wrist, and the pulsation of the arteries still continues, showing that the blood is constantly flowing from the heart into the veins; and the increased size of veins shows that the pressure of the tape prevents its flowing back to the heart.

214. The blood is composed of two parts; *se'rum*, (water,) and *co-ag'u-lum*, (clot.)

215. The blood is not necessarily red. It may be white, as in the fish, and the tendons of man; transparent, as in the insect; or yellowish, as in the reptile.

Observation. To prevent "humors," or to keep the blood pure, and also to purify the blood, attend to the suggestions on exercise, (Chap. IV.,) on food, (Chap. VI.,) the free movements of the ribs and diaphragm, (Chap. VIII.,) and bathing and clothing, (Chap. XI.)

216. The weight of blood in a common-sized man is between twenty-five and thirty pounds.

217. The blood contains all the material necessary for the

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213. Is there pulsation in the veins? Give experiment 1st. Give experiment 2d. 214. Of what is the blood composed? 215. Is the blood always red? What color is it in fish, and the tendons of man? In insects? In reptiles? 216. How much blood does a common-sized man contain? 217. What does the blood contain?

growth of the different parts of the body, as well as to repair the waste which attends the action of the different organs.

218. Every part of the body is constantly changing. In some instances, we can see the change; as in the growth of the nails and hair. But the change that the muscles, bones, and other organs undergo, we cannot see.

219. Thus, in several years, it may be said, that we have new systems. But the change is so gradual that our personal sameness is never lost. The time of the change is not definite, as was supposed by a genuine son of the Emerald Isle, who had been in America *seven years* and three months, and consequently maintained that he was a native American.

220. The useless atoms of the skin, muscles, bones, hair, and other parts of the body, are removed in different ways, and their places are supplied by newly-formed atoms from the blood.

PRACTICAL SUGGESTIONS.

221. To have good health, the blood must circulate freely. No article of apparel should be worn so as to prevent a free flow of blood through every organ of the body.

222. Strings, bands, or belts, however narrow, should not be worn so tightly as to cause an indentation of the skin, of the trunk, or extremities.

223. *Inelastic* bands, worn upon the lower extremities, are a frequent cause of enlarged veins and painful limbs.

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218. Is the body constantly changing? Can we see the change? 219. What may be said of us after the lapse of years? Is the time of the change definite? 220. What becomes of the useless atoms of skin, hair, &c.? How are their places supplied? 221. Is it necessary to health that the blood circulate freely? 222. Is it injurious for bands or strings to cause indentations of the skin, of the trunk, or any part of the body? 223. What is the effect of wearing inelastic bands upon the lower extremities?

224. The fulness and the crimson tint of the face, giddiness, fainting, and many derangements in the functions of different organs, are produced by pressure upon the blood-vessels of the trunk.

225. The skin should be kept clean, and every part of an equal temperature, as these conditions favor free and vigorous circulation.

Observation. When intending to ride in a cold day, wash the face, hands, and feet, in cold water, and rub them smartly with a coarse towel. This is far better than to take spirits into the stomach to keep the extremities warm.

226. Muscular exercise is important in maintaining a healthy circulation. The muscles, when used, force the blood more rapidly to and from the heart.

Illustration. The coach-driver and teamster throw their arms around their bodies to warm them, when cold; because the muscles that are called into action in swinging the arms, force a greater quantity of blood into the chilled parts, and more heat is produced.

227. Idle men and women, who complain of cold feet, and take "warming bitters" to quicken the blood, would find themselves warmer and more invigorated by calling the muscles into action in the mechanic's shop, or the kitchen, or in some active employment.

Observation. In cold weather, when travelling in cars, the feet will not become chilled so readily when standing as when sitting. Again, the feet will be warmer by allowing them to swing, instead of being supported the whole time,

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224. What is a frequent cause of giddiness, faintness, and derangement of the functions of many organs? 225. In what condition should the skin be kept? Give observation. 226. What is the effect of muscular exercise upon the circulation of blood? Give illustration. 227. What is better for cold feet and hands than "warming bitters"? Give observation.

because the muscles, called into action in swinging them, increase the circulation of the blood.

228. When large blood-vessels are wounded or cut, the flow of blood must be immediately stopped, or the person will soon die.

229. If a large artery be wounded, the blood will be thrown out in jets, or jerks, every time the pulse beats.

Fig. 40. Fig. 41.

Fig. 40. The track of the large artery of the arm. 1, The collar-bone. 9, 10, The large artery of the arm.

Fig. 41. B, Represents the manner of compressing the artery near the collar-bone. A, The manner of compressing the large artery of the arm with the fingers. C, The manner of compressing the divided extremity of an artery in the wound, with a finger.

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228. What is necessary when large blood-vessels are wounded or cut? 229. What is the appearance if an artery be wounded? What is shown by fig. 40? What is shown by fig. 41?

230. The flow of blood can be stopped until a surgeon arrives, either by compressing the vessel between the wound and the heart, or by compressing the end of the divided artery in the wound.

231. After making compression with the fingers, as described and illustrated, take a piece of cloth or handkerchief, twist it cornerwise, and tie a hard knot midway between the two ends. This knot should be placed over the artery between the wound and the heart, and the ends carried around the limb and loosely tied. A stick, five or six inches long, should be placed under the handkerchief, which should be twisted until the knot has made sufficient compression on the artery to allow the removal of the fingers without a return of bleeding. Continue the compression until a surgeon can be called.

Fig. 42.

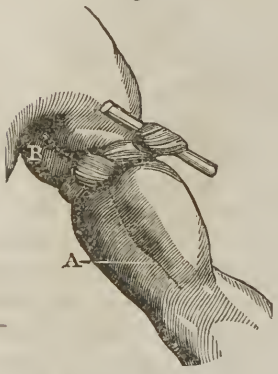

Fig. 43.

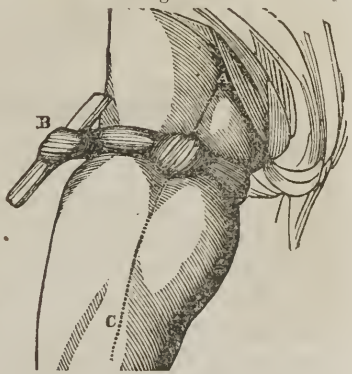

Fig. 42. A, B, The track of the large artery of the arm. C, The method of applying the knotted handkerchief to make compression on this artery.

Fig. 43. A, C, The track of the large artery of the thigh. (See Fig. 36.) B, The method of applying the knotted handkerchief to compress this artery.

230. How can the flow of blood be stopped? 231. What is to be done after compressing the wound as before described? What is shown by figs. 42, 43?

Observation. When an artery of the arm is cut, elevating the wounded limb above the head will tend to arrest the flow of blood. In a wound of a lower limb, raise the foot, so that it shall be higher than the hip, until the bleeding ceases.

Illustration. On one occasion, the distinguished Dr. Nathan Smith was called to a person who had divided one of the large arteries below the knee. After trying, in vain, to find the bleeding vessel, so as to secure it, he caused the foot to be elevated higher than the hip. At first, the blood was forced from the wound about twelve inches; in a minute, it was diminished to three or four; and, in a short time, the bleeding ceased. This Dr. S. called his "*great*" operation; and it was truly great in *simplicity* and *science.*

Fig. 44.

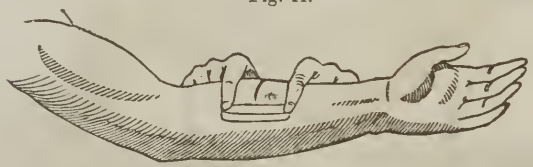

Fig. 44, Represents the manner in which strips of adhesive plaster are applied to wounds.

232. In "flesh wounds," when no large blood-vessel is divided, wash the part with cold water, and, when bleeding has ceased, draw the wound together, and retain it with narrow strips of adhesive plaster. These should be put on smoothly, and a sufficient number applied to cover the wound. In most instances of domestic practice, the strips of adhesive plaster are too wide. They should not exceed in width one fourth of an inch. Then apply a loose bandage, and avoid all "healing salves," ointments, and washes.

Give observation. Relate a simple operation by Dr. Nathan Smith. 232. How should "flesh wounds" be dressed?

233. The union of the divided parts is effected by the action of the divided blood-vessels, and not by salves and ointments. The only object of the dressing is to keep the parts together, and protect the wound from air and impurities. *Nature*, in all cases of wounds, performs her own cure. Such simple wounds do not generally require a second dressing, and should not be opened till the wound is healed. In removing the dressing from a wound, both ends of the strips of plaster should be raised and drawn towards the wound. The liability of the wound re-opening is thus diminished.

Fig. 45.

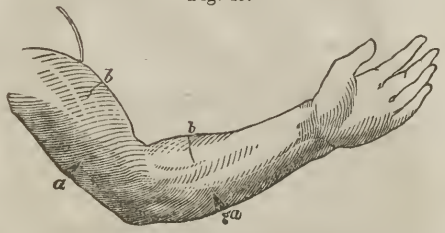

Fig. 45. *a*, *a*, Represent wounds on the back part of the arm and forearm. *b*, *b*, Wounds on the anterior part of the arm and forearm. By bending the elbow and wrist, the wounds at *a*, *a*, are opened, while the wounds at *b*, *b*, are closed. Were the arm extended at the elbow and wrist, the wounds at *a*, *a*, would be closed, and those at *b*, *b*, would be opened.

234. The proper position of the limbs favors the union of wounds. If the wound be upon the anterior part of the leg, between the knee and ankle, extending the knee and bending the ankle will aid its closing. If the wound be upon the back part of the leg, by extending the foot and bending the knee, the gaping of the wound will be diminished. When wounds occur upon the trunk, let the position of the person be regarded.

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233. How is the union of the divided parts effected? What should be avoided? How should the strips of plaster be removed from a wound? 234. Does the proper position of the limbs favor the union of wounds?

Fig. 46.

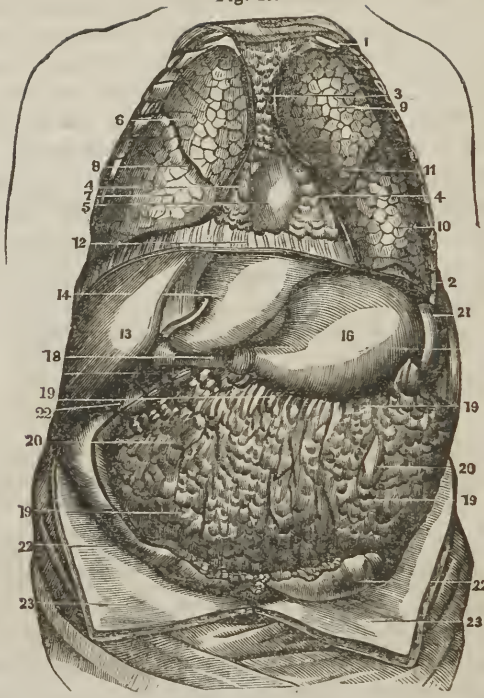

Fig. 46. A view of the organs of the chest and abdomen. The front walls of each cavity are removed. 1, 2, The ribs. 3, Fat between the lungs. 4, 4, Fat surrounding the heart. 5, The heart. 6, 7, 8, The right lung. 9, 10, 11, The left lung. 12, The diaphragm. 13, 14, The right and left lobe of the liver. 16, The stomach. 18, The upper portion of the small intestine. 19, 19, 19, 19, The omentum, (caul.) 20, 20, The small intestines, seen through the caul. 21, The spleen. 22, 22, 22, The large intestine. 23, 23, The walls of the abdomen turned down.

CHAPTER VIII.

THE RESPIRATORY ORGANS.

235. The respiratory organs are the *Lungs*, *Trachea*, and its branches.

236. The *ribs*, *di'a-phragm*, and several small muscles, aid in *res-pi-ra'tion*, or breathing.

237. The Lungs (lights) are situated on each side of the chest, having the heart between them. (See fig. 46.)

238. The Diaphragm (midriff) forms the floor of the chest, upon which the lungs rest. It separates the lungs and heart from the stomach and liver. (See fig. 46.)

239. The Trachea (windpipe) is situated in the front part of the neck, and extends from the mouth to the lungs. Through it the air passes to and from the lungs.

240. This canal, formed of cartilaginous rings, divides, behind the upper part of the heart, into two branches, called *bron'chi.*

241. One branch passes to the right lung; the other branch passes to the left lung.

242. The Air-cells are very small sacs or bladders at the end of the minute divisions of the bronchi.

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235. Name the respiratory organs. 236. What other organs aid in breathing? 237. Where are the lungs situated? 238. Describe the diaphragm. 239. Describe the trachea. Does the air that goes to the lungs return through the trachea? 240. Of what is it formed? Where does it divide into two branches? What are these branches called? 241. Where do they pass? 242. Describe the air-cells.

Illustration. The *trachea* may be compared to the trunk of a tree; the *bronchi*, to two large branches; the subdivisions of the bronchi, to the branchlets and twigs; the air-cells, to the buds seen on the twigs in the spring.

Fig. 47.

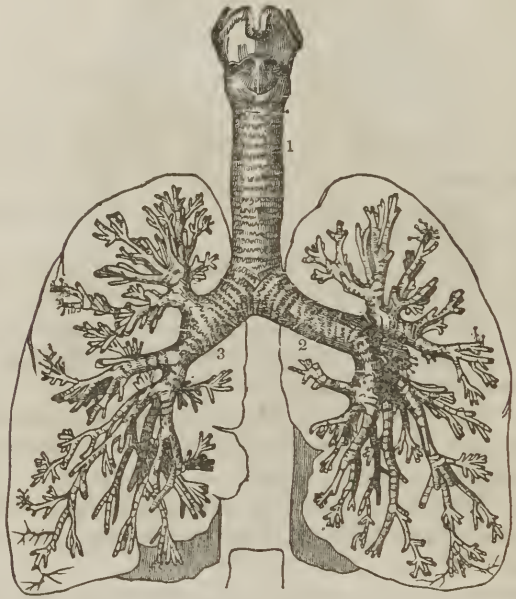

Fig. 47. The trachea and its divisions in the right and left lung. 1, The trachea. 2, The branch that passes to the left lung. 3, The branch that passes to the right lung.

243. The lungs are composed of air-cells and tubes, beside many small blood-vessels.

244. These tubes, cells, and blood-vessels, are surrounded by a membrane, called the *pleu'ra.*

Give illustration. What does fig. 47 represent? 243. Of what are the lungs composed? 244. What surrounds these vessels?

245 In breathing, the ribs are raised in front by muscles that are placed between and on them. This increases the diameter of the chest, as the ribs are situated obliquely. (See fig. 51.) When they are elevated, the central part of the diaphragm, which bulges into the cavity of the chest, is depressed.

Fig. 48.

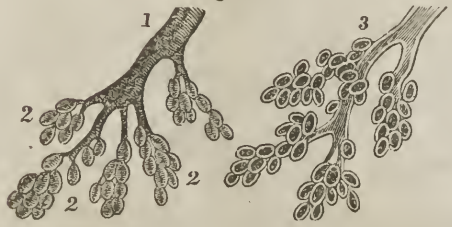

Fig. 48. The bronchial or air-tubes and cells. 1, An air-tube. 2, 2, 2, Air-cells. 3, An air-tube and cells laid open.

246. In this way, the cavity of the chest enlarges, and the air rushes, through the mouth and nose, into the trachea and its branches, to fill the air-cells. This is called *in-spi-ra'tion.*

247. The chest is diminished in size by the contraction of the abdominal muscles, (see 22, 23, fig. 21,) and the air is forced from the lungs through the trachea, and escapes at the mouth or nose. This is called *ex-pi-ra'tion.*

Experiment. Place the ear upon the chest of a person, and a murmuring sound, somewhat like the soft sighings of the wind through forest trees, will be heard. This sound is caused by the air rushing in and out of the lungs, and is peculiarly distinct in the child.

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245. When we breathe, how are the ribs raised? Why does the elevation of the ribs increase the size of the chest? What effect has it on the diaphragm? What is represented by fig. 48? 246. Describe how the air-cells are filled with air. What is this process called? 247. How is the chest diminished in size? What is this process called? Give an experiment.

248. The air-cells are most numerous in the middle and lower part of the lung. When they are filled with air, the lung is soft and spongy, and will float on water. This is the probable reason that they are improperly called "lights."

249. The air which fills these cells, or atmospheric air, is composed of two gases, *ox'y-gen* and *ni'tro-gen*.

Fig. 49.

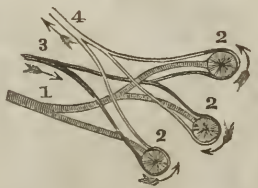

Fig. 49. 1, A bronchial tube divided into three branches. 2, 2, 2, Air-cells. 3, Branches of the pulmonary artery, that spread over the air-cells. Through the pulmonary artery the dark, impure blood is carried to the air-cells of the lungs. 4, Branches of the pulmonary vein, that commence at the minute terminations of the pulmonary artery. Through the pulmonary vein the red blood is returned to the heart.

250. As the impure blood is passing in the minute vessels over the air-cells, the oxygen passes through the thin coats of the air-cells and blood-vessels, and unites with the blood. At the same time, the carbonic acid gas leaves the blood, and passes through the coats of the blood-vessels and air-cells, and mixes with the air in the cells, and is thrown out of the system every time we breathe. This interchange of gases produces the change in the color of the blood.

Experiment. Fill a bladder with dark blood drawn from any animal. Tie the bladder closely, and suspend it in the air. In a few hours, the blood next the membrane will have become of a bright red color. This is owing to the oxygen from the air passing through the bladder, and uniting with

248. Where are the air-cells the most numerous? What is the appearance of the lungs when filled with air? 249. Of what is atmospheric air composed? What does fig. 49 represent? 250. Where does the oxygen of the air mix with the blood? When does the carbonic acid gas mix with the air? Give experiment.

the blood, while the carbonic acid gas has escaped through the membrane.

Fig. 50.

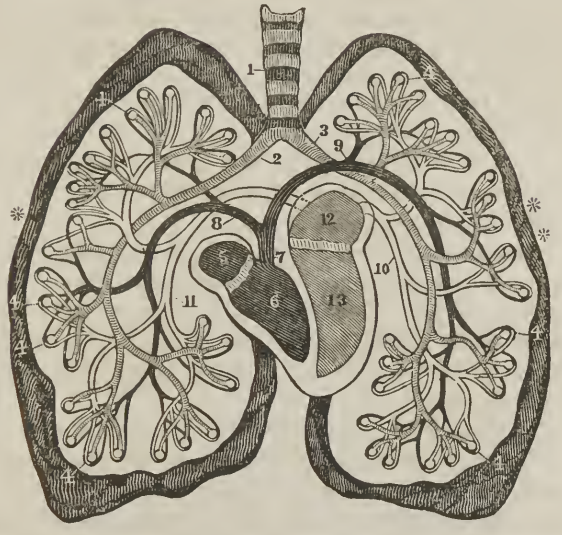

Fig. 50. An ideal view of the pulmonic circulation. 1, The trachea. 2, A branch to the right lung. 3, A branch to the left lung. 4, Air-cells. 5, The right auricle. 6, The right ventricle. 7, The pulmonary artery. 8, The branch to the right lung. 9, The branch to the left lung. 10, The left pulmonary vein. 11, The right pulmonary vein. 12, The left auricle. 13, The left ventricle.

251. Air that has been deprived of a portion of its oxygen, and also contains carbonic acid gas, is injurious if inhaled into the lungs.

Observation. Air in which a lighted candle or lamp will not burn brightly, is unfit to be inhaled into the lungs.

Experiment. Sink a glass jar that has a stop-cock, or one

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251. Is it injurious to breathe air that has been deprived of a portion of its oxygen? How can we detect the presence of an undue amount of carbonic acid gas? Illustrate this by an experiment.

with a glass stopper, into a pail of water, until the air is expelled from the jar. Fill the lungs with air, and retain it in the chest a short time, and then breathe into the jar, and instantly close the stop-cock. Close the opening of the jar that is under the water with a piece of paper laid on a plate of sufficient size to cover the opening, invert the jar, and sink into it a lighted candle. The flame will be extinguished as quick as if put in water.*

252. The dark color of the blood is owing to the presence of carbonic acid gas. This is formed in the blood-vessels by the union of carbon and oxygen.

Observation. Charcoal is carbon in an impure state. When coal is burning, the oxygen unites with it and forms carbonic acid gas. This gas, when taken into the lungs, produces death. Many persons have been killed by sleeping in rooms warmed by burning charcoal in an open pan, or portable furnace.

253. Carbon is supplied to the blood through the food. It is carried out of the system, not only by the lungs, but by the skin and other organs.

Experiment. Breathe into lime-water, and in a few minutes it will become of a milk-white color. This is owing to the carbonic acid gas of the breath uniting with the lime, forming the *carbonate* of *lime.*

PRACTICAL SUGGESTIONS.

254. The cavity of the chest is increased in size in two ways. 1st. By the contraction of the muscles that elevate

* As a substitute for a jar with a stop-cock, take a piece of lead pipe bent in the form of a siphon, and insert it in the mouth of a reversed jar.

252. To what is the dark color of the blood owing? Where is this gas formed? Why is it injurious to sleep in a room where charcoal is burning in an open furnace? 253. From what source is the carbon of the system derived? How is it carried out of the system? 254. How is the cavity of the chest increased in size?

the ribs. 2d. By the depression of the central convex portion of the diaphragm.

255. When the dress restricts or prevents the movements of the ribs and diaphragm, the chest is not duly enlarged, and consequently the air-cells are not properly filled with air.

256. When the air-cells are not properly filled, the impure blood is not suitably changed, and is carried again into the different organs of the body, causing disease.

Fig. 51. Fig. 52.

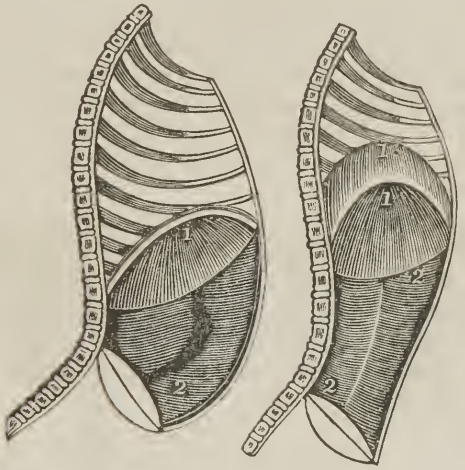

Fig. 51. A section of the chest when the lungs are inflated. 1, The diaphragm. 2, The muscular walls of the abdomen.

Fig. 52. A section of the chest when the lungs are contracted. 1, 1, The diaphragm. 2, 2, The muscular walls of the abdomen.

These engravings show the diaphragm to be more convex, and the walls of the abdomen more flattened, when the lungs are contracted, than when they are inflated.

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255. What effect has tight clothing upon the ribs and diaphragm? 256. What is the effect when the air-cells are not properly filled with air? What do figs. 51 and 52 represent?

257. Deformed, small waists are not made in a day or a month, but by steady, and, it *may be*, moderate pressure, week after week.

Observations. 1st. The Chinese, by bandaging the feet of female children, prevent their growth; so that the foot of a *Chinese belle* is not larger than the foot of an American girl of five years.

2d. The American women *bandage their chests*, to prevent their growth; so that the chest of an *American belle* is not larger than the chest of a Chinese girl of five years. Which country, in this respect, exhibits the greatest intelligence?

3d. The chest can be deformed by making the linings of the waists of the dresses tight, as well as by corsets. Tight vests, upon the same principle, are also injurious.

Fig. 53.

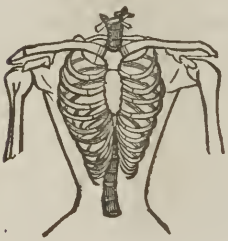

Fig. 54.

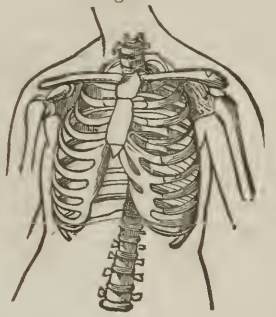

Fig. 53. The skeleton of a deformed chest.
Fig. 54. The skeleton of a well-formed chest.

258. Persons that have large, full chests, particularly at the lower part, are not so liable to diseases of the lungs, as those who have narrow, contracted chests.

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257. How are deformed waists made? How may the chest be deformed, as given by observation 3d? 258. What persons are most free from diseases of the lungs? What does fig. 53 represent? What is represented by fig. 54?

259. A contracted chest, caused either by injudicious dressing, or by any other means, can be enlarged, although the person is thirty years of age, by permitting the muscles that elevate the ribs and diaphragm to perform their proper function.

260. Scholars, and persons who sit much of the time, should frequently, during the day, breathe full and deep, so that the smallest air-cells may be fully filled with air. While exercising the lungs, the shoulders should be thrown back and the head held erect.

Fig. 55. Fig. 56.

Fig. 55. A correct outline of the VENUS DE MEDICI, the *beau idéal* of female symmetry.

Fig. 56. An outline of a well-corseted modern beauty. One has a waist as God formed it; the other, as fashion has *deformed* it.

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259. Can narrow, contracted chests be enlarged? 260. What practice is recommended to scholars and sedentary persons?

261. The air that is breathed from the lungs, is not only deficient in oxygen, and contains carbonic acid gas, but it also contains waste animal matter in a state of vapor.

Observation. This vapor can be seen in a foggy day, or by breathing on glass or any polished surface.

262. If the air be breathed over a number of times, it not only causes lamps to be extinguished, but destroys life. Hence sleeping rooms, sitting rooms, and every room occupied by human beings, should be well ventilated.

Illustrations. 1st. The effects of breathing the same air again and again, is well illustrated by an incident that occurred in one of our halls of learning. A large audience had assembled in an ill-ventilated room, to listen to a lecture; soon the lamps burned so dimly that the speaker and audience were nearly enveloped in darkness. A few minutes after many of the audience had left, the lamps were observed to rekindle, owing to the exchange of pure air on opening the door, which supplied to them oxygen.

2d. The "Black Hole of Calcutta" received its name from the fact, that one hundred and forty-six Englishmen were shut up in a room eighteen feet square, with only two small windows. On opening this dungeon, ten hours after their imprisonment, only twenty-three were alive. The others had died from breathing impure air, that contained animal matter from their own bodies.

263. The sick-room, particularly, should be so arranged that the impure air may escape, and pure air be constantly coming into the room.

264. Curtains around the bed, and the sheet over the face, are injurious. The effect is the same as is produced by sleeping in a small room not ventilated.

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261. What is said of the air that is breathed from the lungs? Give the observation. 262. Why should sitting-rooms, and those we sleep in, be well ventilated? Give illustration 1st. Illustration 2d. 263. How should sick rooms be arranged? 264. What effect have curtains around a bed?

265. Children and adults not unfrequently get foreign bodies into the throat. These accidents require immediate attention. It is not necessary to ascertain which passage the foreign body is in, for the immediate treatment ought in either case to be the same.

266. Some person should place one hand on the front of the chest of the sufferer, and, with the other, give two or three smart blows upon the back, allowing a few seconds to intervene between them.

267. This treatment will generally be successful, and cause the substance to be violently thrown from the throat.

268. To recover persons apparently drowned, it is necessary to press the chest suddenly and forcibly, downward and backward, and instantly discontinue the pressure. Repeat this without intermission, until a pair of bellows can be procured. When the bellows are obtained, introduce the nozzle well upon the base of the tongue, and surround the mouth and nose with a towel or handkerchief, to close them. Let another person press upon the projecting part of the neck, called "Adam's apple," while air is introduced into the lungs through the bellows.

269. Then press upon the chest, to force the air from the lungs, to imitate natural breathing. Continue the use of the bellows, and forcing the air out of the chest, for an hour at least, unless signs of natural breathing come on.

270. Wrap the body in warm, dry blankets, and place it near the fire, to preserve the natural warmth, as well as to impart artificial heat.

271. Every thing, however, is secondary to filling the lungs with air. Send for medical aid immediately. Avoid all friction until breathing is restored.

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265. When foreign bodies, as buttons, beans, &c., get into the throat, what should be done immediately? 268. How should persons apparently drowned be treated?

272. In cases of apparent death from hanging or strangling, the knot should be untied or cut immediately; then use artificial respiration or breathing, as directed in apparent death from drowning.

Observation. It is a vulgar impression, in many sections of the country, that the law will not allow the removal of the cord from the neck of a body found suspended, unless the coroner be present. It is therefore proper to say, that no such delay is necessary, and that no time should be lost in attempting to resuscitate the strangled person.

273. When life is apparently suspended from breathing carbonic acid gas, the person should be carried into the open air. The head and shoulders should be slightly elevated, the face and chest should be sponged or sprinkled with cold water, or cold vinegar and water. Apply friction to the skin, with a coarse cloth or flesh-brush, and resort to artificial respiration.

274. In resuscitating persons apparently dead from the already-mentioned causes, if a pair of bellows cannot be procured immediately, let the lungs be inflated by air expelled from the lungs of some person present. To have the expired air as pure as possible, the person should quickly inflate his lungs and instantly expel the air into those of the asphyxiated person.

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272. How should apparent death from strangling be managed? 273. How should a person be treated who has breathed carbonic acid gas? 274. Give another method of inflating the lungs of an asphyxiated person.

CHAPTER IX.

THE VOICE.

275. The simple yet beautiful mechanism of the vocal instrument, producing every variety of sound, from a harsh, hoarse, unmelodious tone, to a soft, sweet, flute-like sound, can never be imitated by art.

276. It has been compared, by many physiologists, to a *wind*, *reed*, and *stringed* instrument. This inimitable instrument is the *Lar'ynx*.

277. The Larynx (Adam's apple) is a kind of box, situated at the upper part of the *Trachea*, or windpipe.

278. It is composed of several pieces of cartilage, that not only connect with each other, but with the tongue, lower jaw, and trachea.

279. There are stretched across the cavity formed by these cartilages, four folds of membrane, two on each side, called *vocal cords*.

280. The space between the cords on each side is called the *glot'tis*, or chink of the glottis. The cavity between the upper and lower vocal cords is called the ventricle of the larynx.

281. Behind the base of the tongue, is a piece of cartilage, resembling a leaf of parsley, called the *ep-i-glot'tis*.

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275. What is said of the structure of the vocal instrument? 276. What instruments have physiologists compared it with? What is the vocal instrument called? 277. Describe the larynx. 278. Of what is it composed? 279. Describe the vocal cords. 280. What is the space between these cords called? 281. Where is the epiglottis situated?

The duty of this sentinel is to keep the food and drink from passing into the air-passage, or trachea.

Fig. 57.

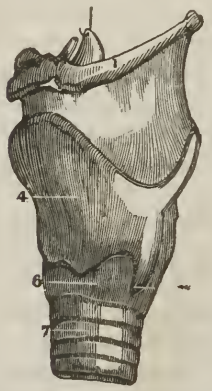

Fig. 58.

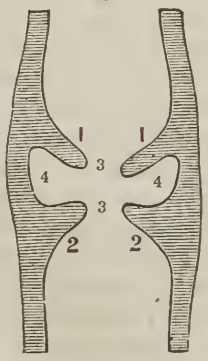

Fig. 57. A side view of the cartilages of the larynx. 1, The bone at the root of the tongue. 4, 6, Cartilages of the larynx. 7, The trachea.

Fig. 58. A section of the larynx. 1, 1, The upper vocal cords. 2, 2, The lower vocal cords. 3, 3, The glottis. 4, 4, The ventricles of the larynx.

282. When air is forcibly driven from the lungs through the glottis, it causes a vibration, or trembling of the vocal cords. This produces *sound;* and it is varied by the tongue, the teeth, and the lips.

283. The state of the muscles that connect the larynx with the chin and tongue, strikingly varies sound.

284. The condition of the mind, as well as the health of the lungs, exerts a great influence over the organs of voice.

What is its use? What does fig. 57 represent? Describe fig. 58. 282. How is sound produced? By what organs is it varied? 283. Does the state of the muscles of the throat affect sound? 284. Does the state of the mind, as well as the health, have an effect on sound?

PRACTICAL SUGGESTIONS.

285. Singing, and reading aloud, improve and strengthen the vocal organs, and should be practised by every youth.

Observation. The enunciation of the elementary sounds of the English language aids in developing the vocal organs, as well as preventing disease of the throat and lungs, (*bronchitis.*) This exercise also conduces to the acquisition of the notes in music.

Fig. 59. Fig. 60.

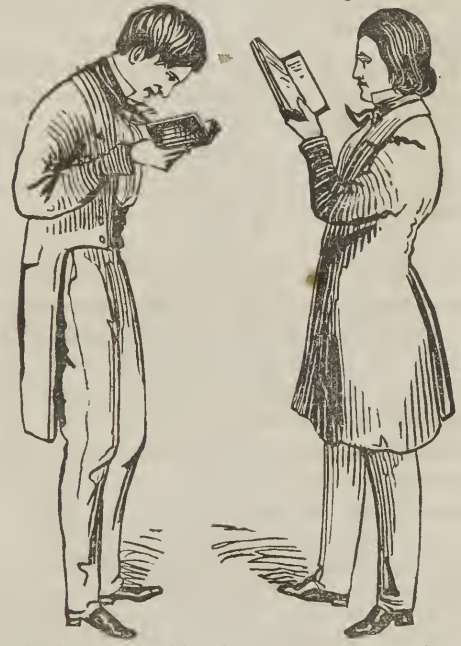

Fig. 59. An improper position, but one not unfrequently seen in some of our common schools, and in some of our public speakers.

Fig. 60. The proper position for reading, speaking, and singing.

285. How may the vocal organs be strengthened? What effect has the enunciation of the elementary sounds of the English language?

286. In reading and singing, whether standing or sitting, the head and trunk should be erect.

287. When the body is erect, the muscles are more under the control of the person, the ribs and diaphragm move with more freedom, and sound is more sonorous and equal.

Experiment. Read with the head bowed forward and chin depressed; then read with the head erect and chin elevated, and observe the difference in the sound.

288. Variation of tone and articulation of words are rendered more or less distinct in proportion as the jaws are separated, and the nose free from obstructions.

289. In teaching a child to talk, have each word spoken correctly, and repeated until it can be uttered with accuracy.

Observation. The drawling method of talking to young children, as well as using words that are not found in any written language, is decidedly wrong. A child will pronounce and understand the application of a correct word as quickly as an incorrect word.

290. The dress about the neck should be *loose*. A tight, high cravat prevents the muscles moving freely, enfeebles the voice, and finally produces disease of the throat and lungs.

291. Pure air produces clearer and more melodious sounds than impure; hence school-rooms, public halls, and churches, should be well ventilated.

292. When individuals have been addressing an audience in a warm room, or engaged in singing, they should avoid all impressions of a cold atmosphere.

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286. What should be the position of the head and trunk when we read or sing? 287. Why should the body be erect? 288. What will render the articulation of words more distinct? 290. How should the dress be worn about the neck? Why? 291. What effect has pure air upon sound? 292. What precaution should lecturers and singers observe?

CHAPTER X.

THE NERVOUS SYSTEM.

293. The *Brain, Spinal Cord,* and *Nerves,* compose this system. These are the most important parts of the body, for all its functions are under their control.

Fig. 61.

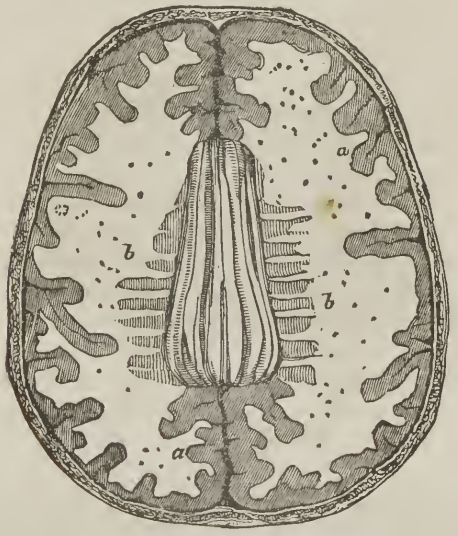

Fig. 61. A section of the bones of the skull and brain. *a, a,* The outer margin of gray matter. *b, b,* The white central part. The dots in the white portion show the situation of divided blood-vessels.

293. What parts of the body compose the nervous system? What is said of their importance? What is shown by fig. 61?

294. The BRAIN is a pulpy organ within the skull-bones.

295. The upper and front portion is called the *Cer'e-brum.*

296. The lower portion, situated at the back part of the skull, is called the *Cer-e-bel'lum.*

297. The cerebrum, or larger portion of the brain, is composed of a whitish substance, with an irregular border of gray matter around its edges.

298. The brain is surrounded with three membranes. The outer membrane (*Du'ra Ma'ter*) is thick and firm.

Fig. 62.

Fig. 62. *a, a,* Represents the scalp turned down. *b, b, b,* The cut edges of the bones of the skull. *c,* The outer membrane of the brain suspended by a hook. *d,* The left side of the brain, showing its convolutions.

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294. Describe the brain. 295. What is the upper portion called? 296. What is the lower portion called? 297. Describe the structure of the cerebrum. 298. How many membranes surround the brain? Give the structure of the outer membrane. What does fig. 62 represent?

299. The middle membrane is thin, and looks somewhat like a spider's web. The inner membrane consists of a network of blood-vessels; through these vessels blood is conveyed to the brain.

300. On removing the upper part of the skull-bones and membranes, the brain presents an undulating, folded appearance. These ridges are called *Con-vo-lu'tions.*

301. There are four cavities in the substance of the brain, called *ventricles.* In "dropsy of the brain," the water accumulates in these cavities.

302. The SPINAL CORD is composed of a whitish substance, similar to that of the brain.

303. It is covered with a sheath or membrane, and extends from the brain through the whole length of the spinal column.

304. The upper portion of the spinal cord within the skull-bone, is called the *Me-dul'la Ob-lon-ga'ta.* (Fig. 63.)

305. The NERVES are small, white cords, that pass from the brain and spinal cord. They are distributed to every part of the human system.

306. The nerves proceed from each side of the brain and spinal cord, at precisely opposite points; hence they are said to pass off in *pairs.*

307. Every nerve, however small, contains two distinct cords of nervous matter. One gives feeling to the part where it is distributed; the other is used in the motion of the part. Both filaments or cords of nervous matter are enclosed in one sheath.

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299. What is said of the middle membrane? Inner membrane? 300. What is the appearance of the brain on removing the upper part of the skull-bones and membranes? What are they called? 301. In dropsy of the brain, where is the accumulation of water? 302. Of what is the spinal cord composed? 303. With what is it covered, and where is it situated? 304. What is that portion of the spinal cord within the skull-bones called? 305. Describe the nerves. Where are they distributed? 306. Whence do the nerves of the body proceed? 307. What does every nerve contain? What is the use of these two tracts of nervous matter? Are they enclosed in one sheath?

Fig. 63.

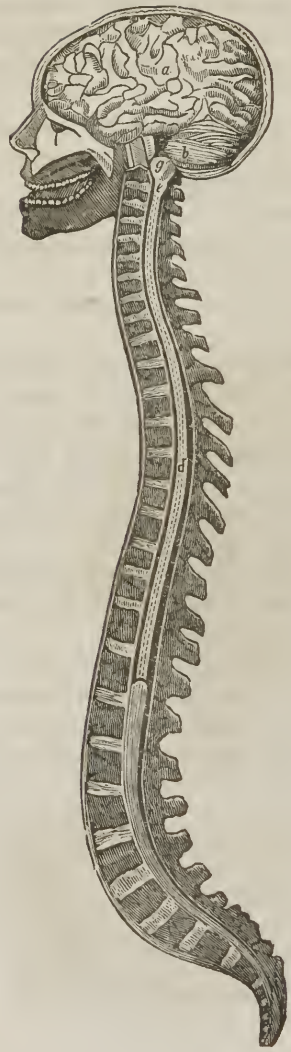

Fig. 64.

Fig. 63. *a*, The cerebrum. *b*, The cerebellum. *g*, Medulla oblongata. *e*, *d*, The spinal cord. The brain, spinal cord, and bones of the spinal column, are represented as divided into two halves.

Fig. 64. A, The cerebrum. B, The cerebellum. C, C, The spinal cord, surrounded by its sheath, and commencement of twenty-nine pairs of nerves.

308. These small cords carry to the brain the news of the actual condition of every organ, as rapidly as Professor Morse's Magnetic Telegraph conveys the news from one city to another.

309. Twelve pairs of nerves pass from the brain, and are generally distributed to the parts about the face.

Fig. 65.

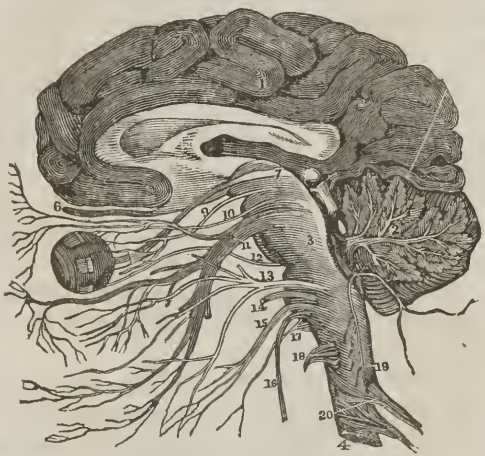

Fig. 65. A section of the brain, and commencement of the spinal cord. 1, The cerebrum. 2, The cerebellum. 3, 4, The spinal cord. 6, The nerve that goes to the nose, (*ol-fac'to-ry.*) (See fig. 72.) 7, The nerve that goes to the eye, (*op'tic.*) (See fig. 77.) 9, 10, 12, Small nerves that go to the muscles of the eye. (See fig. 81.) 11. The nerves that go to the teeth and tongue. (See fig. 71.) 13, A nerve that goes to the muscles of the face. (See fig. 21.) 14, The nerve that goes to the ear, (*au'di-to-ry.*) (See fig. 75.) 15, 16, 17, The nerves that go to the larynx and tongue. 18, 19, 20, Nerves of the neck.

308. What is the use of each nerve? 309. How many pairs of nerves pass from the brain?

310. Thirty-one pairs of nerves pass from the spinal cord.

311. The nerves of the neck, arms, and fingers, pass from the upper portion of the spinal cord.

312. The lower portion of the spinal cord supplies nerves to the lower extremities.

313. Through the brain, the mind acts or *wills;* hence, from the form of the skull-bones, it is called, poetically, the "dome of thought."

314. The condition of the brain is changed by the action of the mind.

Illustration. If we think intensely of a subject, the face will become flushed, and dizziness or pain of the head will be induced. Change our thoughts to something of a more trifling character, and the peculiar sensation in the head will cease.

315. The brain is not only the seat of the *Will*, but it perceives every sensation.

Illustration. Prick the skin with a needle, and the small nerve that is wounded carries the news to the brain, and we feel a sensation called *pain.*

316. If the brain be diseased, and cannot perform its functions, then pain is not felt, and the person thus diseased falls into a state resembling sleep.

317. Contraction or movement of the muscles is caused by an influence sent from the brain through the nerves. If the nerves be cut or compressed, the motion and sensation are destroyed in the part to which they are distributed.

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310. How many pairs of nerves pass from the spinal cord? 311. Where are the nerves from the upper portion of the spinal cord distributed? 312. Where are the nerves of the lower portion of the spinal cord distributed? 313. Through what organ does the mind act? 314. Does the state of the mind affect the brain? Give an illustration. 315. What organ perceives sensation? Give an illustration. 316. If the brain be diseased, what effect will it have on sensation? 317. What causes the fibres of the muscles to contract?

Fig. 66.

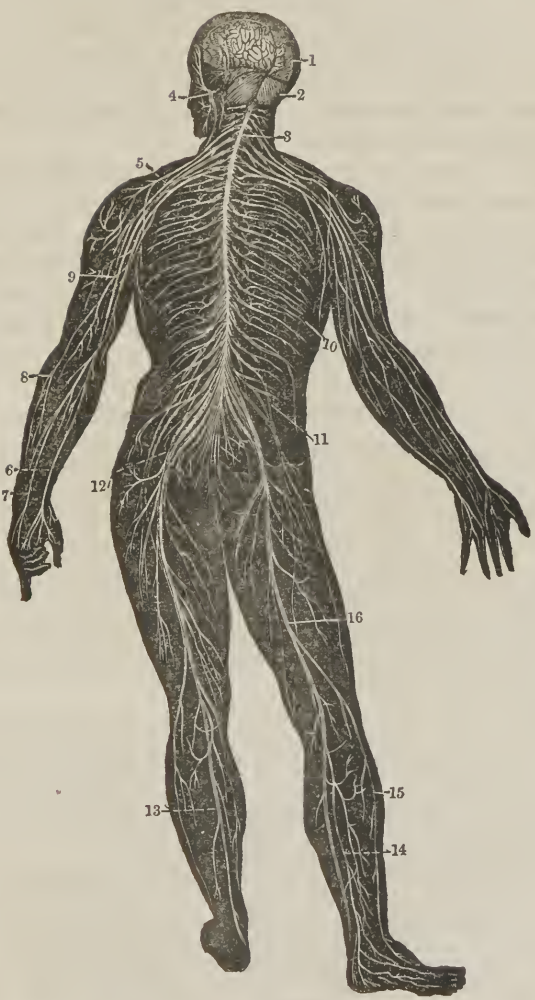

Fig. 66. A back view of the brain and spinal cord. 1, The cerebrum. 2, The cerebellum. 3, The spinal cord. 4, Nerves of the face. 5, 6, 7, 8, 9, Nerves of the arm. 10, Nerves that pass under the ribs. 11, 12, 13, 14, 15, 16, Nerves of the lower limbs.

318. There is another system of nerves, which do not confer either sensibility or power of movement. They are called *sympathetic nerves.*

319. These nerves have a union or sympathy with the different organs of the body.

Illustration. When the brain is jarred by a blow, nausea and vomiting follow. Again, when food is taken that irritates the nerves of the stomach, it produces headache, from the sympathy of the brain with the stomach, through this system of nerves.

PRACTICAL SUGGESTIONS.

320. The brain, like the muscles, should be used, and then allowed to rest, or cease from vigorous thought.

Observation. Many students use the brain too many hours without rest. When there is an inability to remember facts, dizziness, or a confusion of ideas, study is then of little or no utility.

321. The number of hours that the brain should be vigorously used depends on its development, and the general health of the body.

322. The child with a large brain and an active mind, should never be stimulated, by praise or rewards, to pursue studies above the capacity of children generally. On the other hand, children of sluggish minds, particularly if they have good health, should be incited to study.

323. The child that has a frail, feeble body should not

318. Name another system of nerves in the body. 319. Do these nerves have a union with the different organs of the body? 320. What rule is given in regard to the brain? 321. How long should the brain be actively used? 322. Give illustration. 323. Should the child that is feeble be confined to the school-room?

be chosen from his more healthy brothers, to spend the little strength of body and mind that he may possess, in our seminaries and colleges, but should have out-of-door exercise, to increase the strength of his system.

Observation. Let the Latin maxim, "Mens sana in sano corpore," (a *sound mind* in a *sound body*,) be taught in every school-room.

324. When the brain is properly called into action by moderate study, it increases in size and strength.

325. If the brain be not used, it becomes enfeebled, thereby diminishing the function of the organs of the body.

326. Repetition of mental action is as important as repetition of muscular action. It is by this means, that thoughts are durably impressed upon the brain.

327. Studies that require close application should be pursued in the morning. The evening should be devoted to entertaining conversation, music, and light reading. This will fit the system of the student for quiet and refreshing sleep.

Observation. The idea of gathering wisdom by burning the "midnight oil" is more poetical than profitable. The best time to use the brain is during the day.

328. To keep the brain in health, it should be supplied with a due amount of pure blood.

Illustration. 1st. If a person lose a considerable quantity of blood, dizziness and loss of consciousness follow. 2d. The exhaustion of teachers and scholars arises, in many

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What would be better for him? What Latin maxim should be taught in every school-room? 324. What is the effect when the brain is properly called into action? 325. What is the effect if the brain be not used? 326. How are thoughts durably impressed upon the brain? 327. When should abstruse, or the severer studies be pursued? 328. Why should the brain be supplied with pure blood? Give illustration 1st. Illustration 2d.

instances, from breathing bad air, thus causing impure blood to be sent to the brain.

329. In restoring a sick person to health, it is very important that the brain and nervous system be acted upon by pure blood; consequently they should breathe pure air at night as well as by day.

330. Sick-rooms should not only be well ventilated, but they should be kept quiet. No person should visit a sick-room unless he has some duty to perform for the sick person. This remark should be as strictly observed with the child as with the adult.

331. In injuries of the brain, the person is generally insensible, the extremities are pale and cold, the pulse feeble, and the breathing is less full and deep. When these symptoms exist, the patient should be placed in pure air. Friction, with dry warmth, should be applied to the extremities, to restore proper circulation in the blood-vessels. There should be no bleeding until the skin of the extremities becomes warm.

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329. Is it of great importance that the brain and nervous system of a sick person be acted upon by pure blood? 330. Should the sick-room be kept quiet? 331. What is the general state of the body when the brain is injured? Give the treatment under such circumstances.

CHAPTER XI.

THE SKIN.

332. The skin of the human body is composed of two layers of membrane; namely, the *cu'ti-cle*, and the *cu'tis ve'ra*, or true skin.

333. The Cuticle, or external skin, is, at first, a fluid thrown out by the blood-vessels over the internal layer of the skin.

334. While layers of this fluid are continually forming on the upper surface of the *cutis vera*, the external layers of the fluid become dry, and resemble small scales.

Illustrations. The cuticle is that part of the skin which is raised by a blister. It is also frequently seen peeling from the face and hands in small pieces.

335. The arrangement of the cuticle, in different parts of the human body, is worthy of notice. Where feeling is most acute, the cuticle is delicate and thin. Where there is motion, as over the joints, it is lax and movable. Where it is in constant use, it becomes harder and thicker.

Illustrations. The soles of the feet and the palms of the hands afford good examples of cuticle thickened by use.

336. The cuticle has no blood-vessels or nerves; conse-

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332. How many layers of membrane has the skin? What are they called? 333. How is the cuticle first formed? 334. What is the appearance of the external layers? Give illustration. 335. Mention the arrangement of the cuticle in different parts of the body. 336. Has the cuticle blood-vessels or nerves?

quently, a needle may be passed under it, to some extent, and cause no pain, nor will any blood ooze from it.

337. Its use is to protect the delicate vessels which are situated in the internal layer of the skin.

338. The cuticle, when clean, looks like a thin shaving of soft, clear horn; but when filled with dust and other foul matter, it becomes dark colored.

339. In the inner and newly-formed layers of the cuticle, there exists a peculiar kind of paint.

Fig. 67.

Fig. 67. 1, 1, The cuticle. 2, 2, The colored layer of the cuticle. 4, 4, The net-work of nerves. 5, 5, The true skin. 6, 6, 6, Three nerves that divide to form the net-work, (4, 4.)

340. This colored layer, in the Negro, is black; in the Indian, copper colored; in the European, it is very light, differing, however, in different persons.

341. The Cutis Vera, or true skin, is so called because

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337. What is its use? 338. What is the general appearance of the cuticle? 339. What is found in the inner and newly-formed layers of the cuticle? 340. What color is it in the Negro? Indian? European? 341. Why is the cutis vera so called?

it is the most essential of the two layers of the skin. It contains several sets of vessels; namely, *Arteries*, *Veins*, and *Ab-sorb'ents*.

342. In this layer, beside these vessels, there are found both oil and *per-spi'ra-to-ry* (sweat) glands, and nerves.

343. The arteries and veins form a net-work upon the surface of the true skin; hence, cut any part of this layer of skin, and it will bleed. By the arteries the skin is nourished.

Observation. When this layer of skin is destroyed by cuts or burns, it is never formed again, and produces scars which do not disappear.

Fig. 68.

Fig. 68. A, A, Arterial branches. B, B, Capillary or hair-like vessels, in which the large branches terminate. C, The venous trunk, collecting the blood from the capillaries.

344. The nerves, like the blood-vessels, are very numerous, for no part of the skin can be pricked or cut without giving pain.

What does it contain? 342. What vessels exist in this layer beside the last mentioned? 343. What do the arteries and veins form upon the true skin? By what vessel is the skin supplied with blood? Give the observation. 344. Are the nerves numerous upon the true skin?

345. By this sensibility, we are warned not to handle heated bodies, nor expose the system suddenly to a cold atmosphere.

346. The absorbents are those small vessels which open upon the inner layers of the cuticle. These vessels are called into action when ointments are rubbed on the skin; and also in vaccination, to prevent the small-pox.

Observations. 1st. When removing the skin from animals that have died of disease, and in handling poisonous matter, either vegetable or mineral, care should be taken that the cuticle of the hand be not broken.

2d. If the skin is cut or punctured while removing the skins from animals, immediately wash the wound with pure water, and cover it with "court plaster," or something impervious to moisture.

Fig. 69.

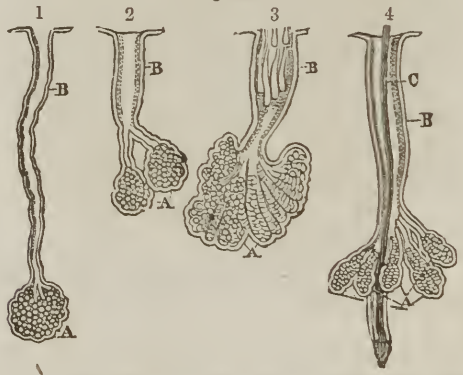

Fig. 69. 1, 2, 3, Oil-glands and tubes from different parts of the body. 4, An oil-gland and tube from the scalp. The glands (A) form a cluster around the tube of the hair, (C.) These ducts open into the sheath of the hair, (B.) The figures, from 1 to 4, are magnified thirty-eight diameters.

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345. What benefit arises from the sensibility of the nerves of the skin? 346. What is said of the absorbent vessels of the skin? When are they called into action? Give the observations. What does fig. 69 represent?

3d. When there are wounds or "sores" on the hand, cover them with "court plaster," or cloth upon which adhesive plaster is spread. It is advisable, when handling poisonous matter, to rub the hands with oil or lard.

348. The skin, when in health, is moistened with an oily fluid, which is separated from the blood by small glands. The ducts of these glands open upon the external layer of the skin.

349. In a few situations, these small glands are worthy of particular attention, as in the eyelids, where they possess great beauty of distribution and form, and open by minute pores along the lids; in the ear passages, where they produce the "wax" of the ears; and in the scalp, where they resemble small clusters of grapes, supplying the hair with a pomatum of nature's own preparing.

350. When there is an unnatural accumulation of oil in the tubes, it produces the "worm," or "grub." The blackened appearance at the end of the tube is produced by dust, which is mixed with the oily matter in the duct. This can be prevented and removed by frequent bathing.

351. The perspiratory glands separate from the blood the perspiration or sweat. These glands have spiral ducts that open obliquely upon the surface of the skin. (13, 14, fig. 70.)

352. There are more than two thousand of these glands, with ducts, in every square inch of skin, and more than five million of them in this natural covering of the body.

353. In health these glands are in constant action, and the skin is moist. When this moisture cannot be seen, it is

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How can we prevent poisonous matter from being carried into the system? 348. What is the use of the oil-glands of the skin? 349. How do these glands appear in different parts of the body? 350. What does an unnatural accumulation of this oily matter produce? 351. What is the use of the perspiratory glands? Where do their ducts open? 352. How many of the ducts upon every square inch of skin? 353. When is perspiration called insensible?

called *insensible* perspiration. When it can be seen in drops, it is called *sensible* perspiration.

Experiment. Put the hand into a dry glass jar, and wind around the wrist and mouth of the jar a handkerchief. In a few minutes, the jar will be covered with moisture from the hand.

354. Perspiration is very necessary to health. During twenty-four hours, from twenty to thirty ounces of waste, useless matter pass out of the body by these ducts, or through the pores of the skin.

Fig. 70.

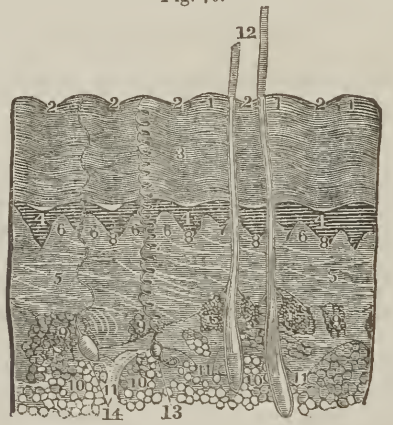

Fig. 70. 1, 1, The ridges of the skin cut perpendicularly. 2, 2, 2, 2, 2, The furrows or wrinkles of the same. 3, The cuticle. 4, 4, 4, The colored layer of the cuticle. 5, 5, The cutis vera. 6, 6, 6, 6, 6, The points, or *pa-pil'læ*, each of which answers to the line on the external surface of the skin. 7, 7, Small furrows between the papillæ. 8, 8, 8, 8, The deeper furrows between each couple of the papillæ. 9, 9, 9, Cells filled with fat. 10, 10, 10, The adipose layer, with numerous fat vesicles. 11, 11, 11, Fibres of the adipose tissue. 12, Two hairs. 13, A perspiratory gland, with its spiral duct. 14, Another perspiratory gland, with a duct less spiral. 15, 15, Oil-glands, with ducts opening into the sheath of the hair, (12.)

What is sensible perspiration? Give an experiment. 354. How many ounces of waste matter pass through the pores of the skin in twenty-four hours? Describe fig. 70.

PRACTICAL SUGGESTIONS.

355. If perspiration be checked by any means, the waste matter that should pass through the skin is carried to organs within the body, causing pain and sickness.

356. Perspiration not only contains water, but salt, oil, rust of iron, and other materials.

357. The watery portion is absorbed by the clothing, or evaporates. The salt, &c., if not removed by bathing, or by friction of the clothing, remains upon the skin, closing up the pores, like a kind of varnish.

358. To keep the pores of the skin open, it is necessary to bathe the *whole body* frequently, as perspiration is not confined to the face and hands.

Observation. Cleansing a shirt by washing the wristbands and collar only, would be as worthy of commendation, as washing the face and hands only to cleanse the skin of impurities.

359. Cold water — or water at about 70° in summer, and 80° in winter — is more strengthening to the system than water that is warmer.

360. No person should bathe when the body is fatigued, either by mental or physical labor, or immediately after a meal.

361. The best time for bathing, particularly for sick persons, is about two hours after breakfast. Persons in health may bathe in the morning or in the evening.

362. The simplest, and, perhaps, the best method of bathing, is the *sponge* bath. In this, but a small portion of the

355. What is the effect if perspiration be checked? 356. What does perspiration contain? 357. What becomes of the watery portion? Of the salt, &c.? 358. Why is it necessary to bathe? 359. What temperature of water is best for the system? 360. When should persons not bathe? 361. When should persons bathe? 362. What method is the simplest for bathing?

surface of the skin is exposed to the air, and the brisk rubbing that immediately follows the wet sponge, prevents a chill of the skin.

363. No colds would be contracted in bathing, if persons would wipe dry, and use friction with a coarse towel or flesh-brush, until redness or warmth of the skin is produced.

364. Perspiration may be checked by diminishing the circulation of blood in the skin. This may be done by wearing clothing which is too tight, or by want of clothing.

365. Any article of dress is warmer upon the body, when there is a layer of air between it and the skin.

Example. A loose mitten is warmer than a tight glove, and a large boot than one that fits snugly.

366. That kind of cloth is best, to prevent the skin being chilled, which contains air between its meshes. For this reason, woollen is better than silk, cotton than linen.

367. When a person has been exercising, and the skin is wet with perspiration, an extra garment, as a shawl or overcoat, should be put on, when riding, or sitting to rest. By observing this suggestion, disease will be prevented.

368. Again, when a person has been actively exercising, a shade or current of air should be avoided, when sitting to rest. It is better to keep up the action of the skin, while under the rays of a summer's sun.

369. In the evening, when the system has been exhausted with labor, more clothing is needed to prevent a chill, than in the morning, when the body has been refreshed by sleep.

Why is it preferred? 363. How are colds prevented when bathing? 364. Does the circulation of the blood have an influence on perspiration? 365. Is clothing warmer when there is a layer of air between it and the body? Give an example. 366. Why is woollen cloth warmer than silk? 367. When we sit or ride immediately after violent exercise, do we need more clothing? 368. Should we sit in a current of air when perspiring freely? 369. What part of the day do we need the most clothing?

370. Change of clothing from thick to thin should be made in the morning, and not in the evening, as the custom is with many who dress for evening entertainments.

371. To prevent rheumatism and many other diseases, reaction, or warmth of the skin, should be induced as soon as a chill is contracted.

372. A frequent change of apparel is necessary, as the fibres of the cloth become covered with the waste matter contained in the perspiration. A neglect of this is one cause of disease with many persons, particularly the poorer classes in the community.

373. The clothing in which we sleep, as well as beds and bed-clothes, should be aired every day. If this be not done, the moist bedding will cause a chill, and the perspired matter may be carried into the system of the next occupant. Many diseases are thus contracted.

374. When the clothing has been wet either by rain or free perspiration, replace it with dry apparel, as the conversion of the moisture into vapor, or "drying the clothing," while on, extracts heat from the system, and causes a "cold," or chill.

375. In all diseases, when the skin is pale and dry, or covered with scales like bran, bathing the whole body, applying friction and proper clothing, will be found beneficial.

376. The amount of clothing that should be worn depends upon the employment, age, and health of the person. No more should be worn than is sufficient to keep up an equal and healthy action of the skin.

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370. What is the best time for changing thick clothing for thin? 372. Why is it necessary to change clothing frequently? 373. Should bed and bed-clothes that are used be aired every day? 374. What is the reason that chills are usually felt when wet clothing is allowed to dry on the body? 375. How can a pale, dry skin become healthy? 376. How much clothing should be worn?

377. An excessive, as well as an insufficient, amount of clothing is alike injurious. The custom of wearing an undue amount on some parts of the body, and leaving exposed the arms and upper part of the chest, cannot be too highly censured.

378. When any portion of the skin has been frozen, apply ice, snow, or cold water. The fire and a warm room should be avoided. If the frozen parts blister, treat them as you would burns.

379. In scalds and burns, when the skin simply looks red, and there is no blister, apply cold water constantly, to prevent a blister.

380. If a blister be formed, and the external skin be not broken, apply cold water, as long as the smarting pain continues. After the pain has subsided, cover the blistered part with a patch of cotton or linen cloth, on which is spread lard and bees-wax.

381. If the external skin be removed, apply lime-water mixed with "sweet oil," fresh cream, or lard and bees-wax.

382. When the dressings are applied, they should not be removed until they become dry and hard.

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377. Is too much, as well as too little, clothing injurious? 378. What should be applied when the skin is frozen? 379. In scalds or burns, when the skin simply looks red, what is necessary? 380. What is necessary if a blister be formed? 381. What is necessary if the external skin be removed? 382. How often should the dressings be removed?

CHAPTER XII.

THE FIVE SENSES.

383. The body not only has organs which promote its growth, but it has means by which the mind becomes acquainted with external objects. This communication is through the *senses*.

SENSE OF TOUCH.

384. This sense enables us to tell whether any thing is rough or smooth, cold or hot, sharp or blunt.

385. It resides in the nerves of the skin. Under the cuticle are found projecting points, called *papillæ*, (fig. 70,) to each of which a branch of a sensitive nerve is sent.

Observation. When the skin is suddenly contracted, these points appear more prominent, and are called "goose flesh."

386. Where sensation is most acute, we find the greatest number of nerves, and those of the largest size, as at the ends of the fingers and lips.

387. Blind persons, by whom the beauties of the external world cannot be seen, cultivate this sense to such a degree that they can distinguish objects with great accuracy.

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383. Through what means does the mind become acquainted with external objects? 384. Of what use is the sense of touch? 385. Where does this sense reside? 386. Why is sensation more acute on the lips and ends of the fingers, than any other part of the body? 387. What persons cultivate this sense to a great degree?

SENSE OF TASTE.

388. It is by this sense that we discern the flavor of any thing.

389. The tongue is the principal agent of taste, though the mouth and upper part of the throat share in this function. This sensation is carried to the brain by the *gus'ta-to-ry* nerve. Many branches of this nerve are distributed to the points upon the surface of the tongue.

Fig. 71.

Fig. 71. The distribution of the gustatory nerve. 1, The orbit for the eye. 2, The upper jaw. 3, The tongue. 4, The lower jaw. 5, The fifth pair of nerves. 6, The first branch of this nerve, that goes to the eye. 9, 10, 11, 12, 13, 14, Divisions of this branch. 7, The second branch of the fifth pair of nerves, that goes to the teeth of the upper jaw. 15, 16, 17, 18, 19, 20, Divisions of this branch. 8, The third branch of the fifth pair, that goes to the tongue and teeth of the lower jaw. 23, The division of this branch that goes to the tongue. *This is the nerve of taste.* 24, The division that goes to the teeth of the lower jaw.

388. By what sense do we know the flavor of any thing? 389. Is the tongue the principal agent of taste? How is this sensation carried to the brain? Describe fig. 71.

Observation. By applying strong acids, as vinegar, to the tongue, with a hair pencil, these points will become curiously lengthened.

390. This sense enables us to select proper food.

391. Substances, to be tasted, must be either naturally fluid, or dissolved by the saliva.

392. The flavor of moist substances is immediately perceived when they come in contact with the end of the tongue. But, if dry and hard, they must be acted upon by the saliva, and then the sensation will be felt at the back part of the mouth.

Observation. Many persons impair their taste by bad habits, as chewing and smoking tobacco, and using stimulating drinks, &c. These indulgences lessen the sensibility of the nerve, and destroy the natural relish for food.

SENSE OF SMELL.

Fig. 72.

Fig. 72. A side view of the passages of the nostrils, and the distribution of the olfactory nerve. 4, The olfactory nerve. 5, The fine and curious divisions of this nerve on the membrane of the nose.

Give observation. 390. What is the use of this sense? 391. In what states must substances be, in order to be tasted? 392. What part of the tongue first perceives the taste of moist substances? If dry and solid, what is necessary? How is taste impaired? What does fig. 72 represent?

393. This sense enables us to discern the odor or scent of any thing. When the air rushes through the nostrils, the odoriferous particles of matter come in contact with the fine nerves, that are spread upon the membrane that lines the nose, or nostrils, and the impression is carried to the brain by the olfactory nerve.

394. This sense, with that of taste, aids man, as well as the inferior animals, in selecting proper food, and it also gives us pleasure by the inhalation of agreeable odors. When much used, it becomes very acute.

395. The North American Indians can easily distinguish different tribes, and different persons of the same tribe, by the odor of their bodies.

396. This sense is seen to be remarkably acute in the dog; he will trace his master's footsteps through thickly-crowded streets, and distinguish them from thousands of others; he will track the hare over the ground for miles, guided only by the odor that it leaves in its flight.

397. Acuteness of smell requires that the brain and nerve of smell be healthy, and that the membrane that lines the nose be thin and moist.

398. Any influence that diminishes the sensibility of the nerves, thickens the membrane, or renders it dry, impairs this sense.

Observation. *Snuff*, when introduced into the nose, not only diminishes the sensibility of the nerves, but thickens the lining membrane. This thickening of the membrane obstructs the passage of air through the nostrils, and obliges "snuff-takers" to open their mouths when they breathe.

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393. By what sense do we discern the odor of any thing? How is the odor or smell of bodies perceived? 394. What is the use of this sense? Does use render it more acute? 395. What is said of this sense among the North American Indians? 396. In the dog? 397. What does acuteness of smell require? 398. What will impair this sense? What effect has snuff upon the nasal organ?

THE SENSE OF HEARING.

399. Hearing is the sense that enables us to perceive sound, through the organ called the ear.

400. The nerve that communicates sound to the brain, is called *auditory*.

401. The ear is divided by anatomists into three parts: 1st, the *External* ear; 2d, the *Middle* ear, or *Tym'pa-num;* 3d, the *Internal* ear, or *Lab'y-rinth.*

402. The external ear is composed of cartilage. It has many ridges and furrows, arising from the folds of the cartilage that form it.

Fig. 73.

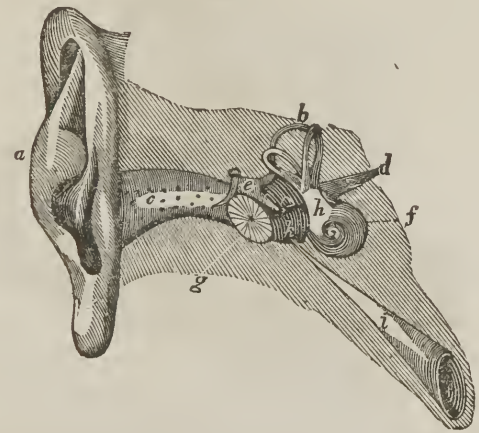

Fig. 73. *a*, The external ear. *c*, The tube that leads to the middle ear. *g*, The drum of the ear. *e*, *k*, The middle ear. *b*, *f*, *h*, The internal ear. *i*, The tube that leads to the throat, (*Eu-sta'chi-an.*) *d*, The auditory nerve.

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399. Through what organ is sound perceived? 400. What nerve communicates sound to the brain? 401. Into how many parts is the ear divided? Name them? 402. Give the structure of the external ear. What is represented by fig. 73?

403. The use of the external ear is to catch and convey sounds into the tube, which extends inward.

Observation. Many animals have small muscles that move the ear, in order to catch sounds from every direction. The hare, rabbit, and horse, afford good examples.

404. At the internal extremity of the tube, is a thin, semi-transparent membrane, that separates the external from the middle ear. It is called *Mem'bra-na Tym'pa-ni*, or "drum of the ear."

405. This and the bitter wax found around the hairs in the tube, prevent insects from entering the head.

Fig. 74.

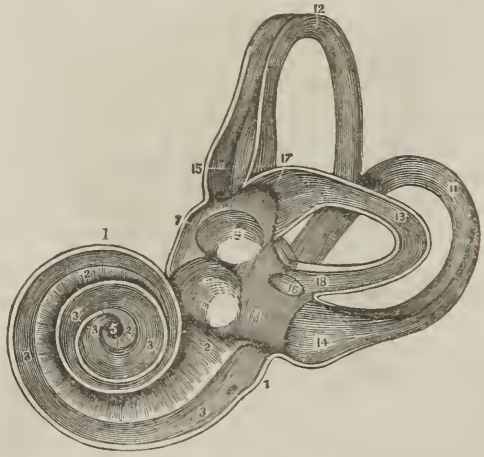

Fig. 74. A view of the labyrinth laid open. This figure is highly magnified. 1, 1, The *coch'le-a*, or snail shell. 2 and 3, Two channels, that wind two and a half turns around a central point, (5.) 7, The central portion of the labyrinth, called the *ves'ti-bule*. 11, 12, 13, 14, 15, 16, 17, and 18, The semicircular canals. The cochlea and semicircular canals open into the vestibule.

403. What is the use of the external ear? Give the observation. 404. What is found at the internal extremity of the tube? What is it called? 405. How are insects prevented from entering the head? Explain fig. 74.

406. The middle ear is connected with the internal and most important cavity, by four small bones. These are so arranged, as to form a chain from the drum of the ear to the labyrinth.

407. From the middle ear, a tube opens into the back part of the throat. (Figs. 73 and 76.) This tube admits air to this cavity of the ear, as the opening in the side of a drum admits air into the interior of that instrument.

Observation. If this tube be obstructed by disease of the throat, it impairs hearing, as the closing of the hole in the side of the drum diminishes the sound.

Fig. 75.

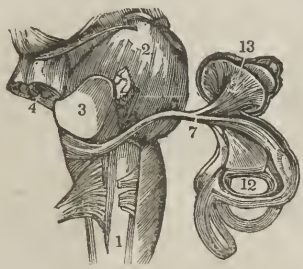

Fig. 75. A view of the auditory nerve. 1, The spinal cord. 2, 3, 4, The lower part of the brain. 7, The auditory nerve. 12, A branch to the semicircular canals. 13, A branch to the cochlea.

408. The internal ear is very intricate, and the uses of its various parts are not well known. It is called the *labyrinth*, from its many windings.

409. This part of the ear is the only one that is absolutely essential in hearing. Other parts, already described, may be removed, and yet the person may hear.

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406. How is the middle ear connected with the internal ear? 407. How does the middle ear communicate with the throat? What is represented by fig. 75? 408. Give the structure of the internal ear. 409. What part of the ear is absolutely necessary in hearing? May the parts of the external and middle ear be removed, and the person hear.

410. The nerve of hearing is spread upon the inner surface of the membrane that lines the intricate windings of the internal ear.

411. The vibrations of the air, producing an influence called *sound*, are collected by the external ear, and conducted through the tube (1, fig. 76) to the drum of the ear. This causes a vibration of the drum of the ear, (2.)

Fig. 76.

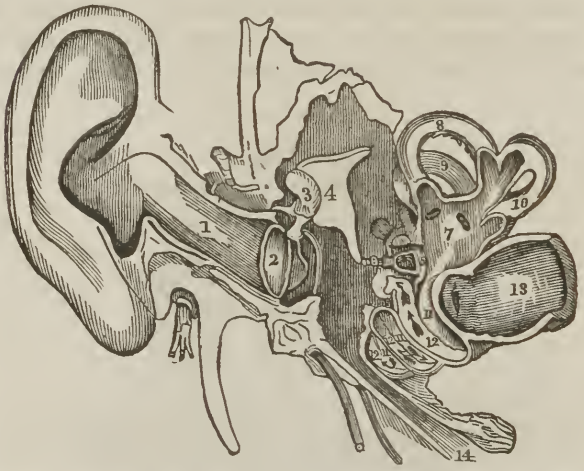

Fig. 76. A view of all the parts of the ear. 1, The tube that leads to the internal ear. 2, The drum of the ear. 3, 4, 5, The bones of the ear. 7, The central part of the labyrinth. 8, 9, 10, The semicircular canals. 11, 12, The channels of the cochlea. 13, The auditory nerve. 14, The channel from the middle ear to the throat.

412. This vibration passes along the chain of bones, (3, 4, 5.) The bone (5) communicates with the internal ear, (7.) From the internal ear the impression is carried to the brain by the nerve, (13.) (See fig. 75.)

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410. Where is the nerve of hearing spread? 411. Explain, by fig. 76, how sound is conveyed to the middle ear.

413. The common causes of impaired hearing are, a thickening of the drum of the ear, and an accumulation of wax upon its exterior surface.

414. This accumulated wax can be removed by softening it with oil dropped into the ear, followed by injections of warm soap-suds.

415. It is injurious to put pins into the ear, as they frequently cause inflammation.

416. When worms and insects find their way into the ear, they can usually be driven out, by dropping in warm olive oil.

SENSE OF SEEING.

417. The beautiful instrument by which we perceive the forms, colors, and dimensions of bodies that surround us, is the *Eye.*

418. This instrument, so useful to us, is shaped like a globe, and is placed in a cavity in front of the skull.

419. This hollow globe, or ball, is filled with certain substances called *Hu'mors.*

420. The sides of the globe are composed of three membranes, or coats.

421. The transparent part of the eye in front, which projects more than the rest of the globe, is called the *Cor'ne-a.* It is shaped like the crystal of a watch, and, in health, gives the eye its sparkling brilliancy.

422. The outermost coat, called *Scle-rot'i-ca,* is firm, and

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413. Give some causes of impaired hearing. 314. How can the accumulation of wax be removed? 415. Is it injurious to put pins into the ear? 416. How can insects be removed from the ear? 417. By what organ do we perceive objects? 418. What is its shape, and where is it placed? 419. With what is the globe of the eye filled? 420. What composes the sides of this globe? 421. Where is the cornea of the eye? Give its structure. 422. What is the outermost coat called?

its color white; hence it is frequently called the "white of the eye."

Fig. 77

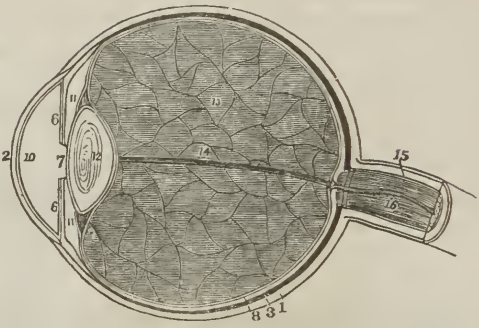

Fig. 77. A section of the globe of the eye. 1, The sclerotic coat. 2, The cornea. This connects with the sclerotic coat by a bevelled edge. 3, The choroid coat. 6, 6, The iris. 7, The pupil. 8, The retina. 10, 11, 11, Chambers or cavities of the eye that contain the aqueous humor. 12, The crystalline lens. 13, The vitreous humor. 15, The optic nerve. 14, 16, One of the arteries of the eye.

423. From its toughness, it forms the principal support to the eye. This membrane, with the cornea in front, encloses the eye.

424. The next membrane is of a dark color upon its inner surface, and, on account of its many blood-vessels, is called the *Cho'roid* coat.

425. The innermost coat is called the *Ret'i-na*, from its resemblance to a net. It is the immediate seat of vision.

426. A short distance behind the cornea is found the most delicate of all the muscles of the body; it is called the *Iris*. This part gives the blue, gray, or black color to the eye.

427. In the centre of the iris is an opening called the

Explain fig. 77. 423. What is the use of the sclerotica? 424. Describe the next coat. 425. What is the innermost coat called? 426. Where is the iris found? What gives the eye its blue or black color? 427. What is situated in the centre of the iris?

*Pu'pil,** which enlarges or contracts, according to the quantity of light that falls upon the eye.

428. The space between the cornea and iris is filled with the *A'que-ous*, or watery humor.

Fig. 78.

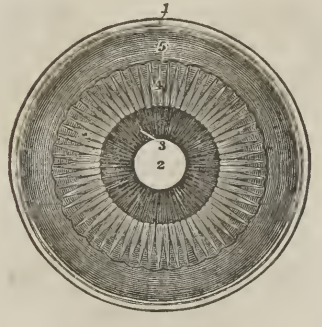

Fig. 78. A transverse section of the eye, seen from within. 1, The divided edge of the three coats. 2, The pupil. 3, The iris. 4, The ciliary processes. 5, The scolloped border of the retina.

429. Behind the aqueous humor and pupil lies the *Crys'tal-line Lens*. Its form is different on the two sides. When boiled, it may be separated into layers like those of an onion.

Observation. The lens in the eye of a fish is round, like a globe, and has the same appearance, when boiled, as the lens of the human eye.

430. The largest and innermost humor is called the *Vit're-ous*. It occupies more than two thirds of the whole interior of the globe of the eye.

* From *pu'pa*, Latin, a babe; because it reflects the diminished image of the person who looks upon it.

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428. What fills the space between the cornea and iris? What does fig. 78 show? 429. Where is the crystalline lens situated? Does the lens in the eye of a fish resemble in structure that of the human eye? 430. What is the largest and innermost humor called?

431. On viewing the part of the eye near the pupil, small lines of a lighter color will be seen passing to the outer part of the iris; these are called *Cil'i-a-ry proc'ess-es.* They are about sixty in number.

Fig. 79.

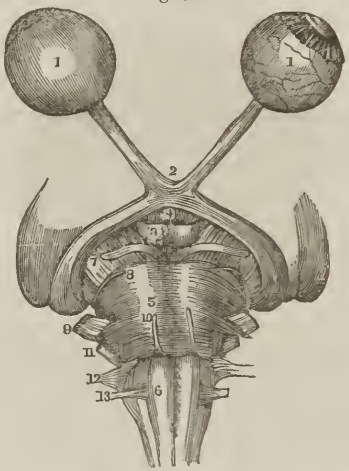

Fig. 79. The second pair, or optic nerves. 1, 1, The globe of the eye. The one on the left is perfect, but the sclerotic coat has been removed from that on the right, to show the retina. 2, The crossing of the optic nerve. 3, 4, A portion of the brain. 5, 6, The commencement of the spinal cord. 7, 8, 9, 10, 11, 12, 13, The origin of nerves.

432. The optic nerve, which comes from the brain, passes through the back of the eye, and forms the netted membrane called the *retina.*

433. The different coats give form to the eye, while the transparent cornea and humors change the direction of the rays of light; so that the rays that leave an object at which we look, form upon the retina a small but clear image of that

431. Where are the ciliary processes? What does fig. 79 show? 432. Describe the optic nerve. 433. Give the use of the coats and humors of the eye. How is the image of objects seen?

object. The impression of the image upon the retina is carried to the brain through the optic nerve.

434. When the cornea and crystalline lens become flattened, as in old age, the image is formed beyond the retina. This defect is remedied by wearing *convex* glasses.

435. When the cornea and crystalline lens are too convex, an image of the object will be formed before the retina. This defect of the eye is called *near*-sightedness. To give such persons longer vision, it is necessary to wear *concave* glasses.

Fig. 80.

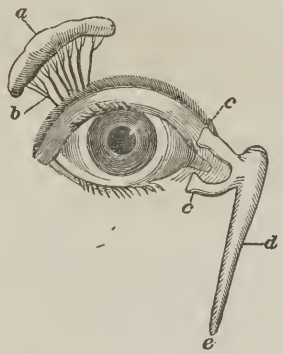

Fig. 80. *a*, The lachrymal gland. *b*, Ducts leading from the lachrymal gland to the upper eyelid. *c*, *c*, Ducts at the inner angle of the eyelids. These open into the nasal sac, (*d*.) *e*, The nasal duct that opens into the nose.

Observation. Persons that train the eye to look at distant objects, as hunters and sailors, are rarely near-sighted; while those who view objects near the eye, as watch-makers and students, are frequently near-sighted.

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434. What is the result when the image is formed beyond the retina? How is the defect remedied? 435. What is the result when the image is formed before the retina? How can this defect be remedied? Explain fig. 80. Give the observation.

436. Children should be taught to view objects at different distances, in order that the eye may adapt itself to view objects near as well as remote.

437. The eye is protected from external injury by the two movable curtains, called *eyelids.* These are opened and closed by small muscles.

438. They are formed of thin cartilage, placed under the skin, that fits the globe of the eye. Attached to the eyelids are the *eyelashes.* When the eye is closed, they interlace, and thus prevent particles of matter from injuring this delicate organ.

439. The eyelids not only protect the eye, by closing it in front, from too brilliant rays of light, and from dust, but distribute equally over the globe of the eye the fluid which moistens it.

440. This fluid flows from small glands above the eye, called *Lach'ry-mal* (tear) glands. Several minute ducts convey it to the eye. It is carried from the eye to the ducts that open upon the edge of the eyelid, near the nose.

441. These two small ducts usually convey the fluid away as quickly as it is formed; but when the eye is irritated, or the mind affected by various emotions, it flows to the eye too rapidly to be conveyed to the nose, and it then courses down the cheek in the form of tears.

442. The cavities or *orbits* of the eye are lined with a thick cushion of fat, in order that the eye may move in all directions with perfect freedom and without friction.

443. The eye is moved by six muscles, one extremity of

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437. How is the eye protected from injury? 438. How are they formed? What are attached to the eyelids? 439. What is the use of the eyelids? 440. Where are the tears formed? How is it conveyed to the eyes? How from the eyes? 441. What is the effect when the eye is irritated? 442. What are the orbits of the eye lined with? What is its use? 443. How many muscles move the eye?

which is attached to the bones of the orbit; the other extremity to the globe of the eye.

Fig. 81.

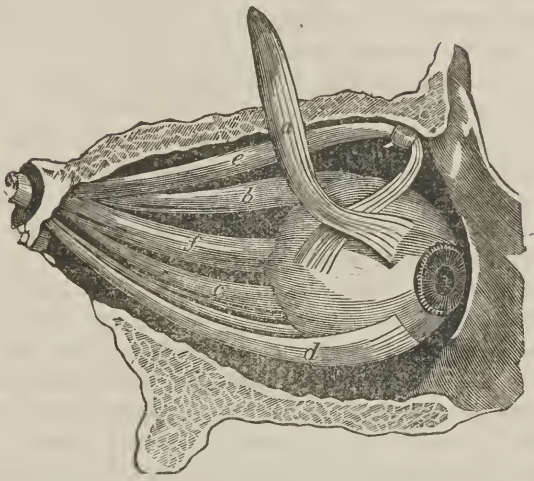

Fig. 81. A view of the eye and its muscles. *a*, *b*, *c*, *d*, *e*, Five of these muscles. *f*, The optic nerve. The bone is seen above and below the eye.

444. *Stra-bis'mus* (cross-eye) is caused by a contraction of one of these muscles. If the external muscle is too short, the eye is turned out; if the internal muscle is contracted, the eye is turned inward toward the nose.

Observation. The vision of a "cross-eye" is always defective. This defect can be remedied by a surgical operation, which corrects also the position of the eye.

445. In using the eye, it should be fixed on an object but a short time, before it is allowed to rest. Nor should it be

444. How is strabismus, or "cross-eye," produced? How is the vision of such eyes? Can the defect be remedied? 445. How should the eye be used?

used in intense light but a few minutes, as a glare of light frequently produces blindness.

446. Small particles or dust may become lodged in the eye, and produce much inconvenience, which is often increased by harsh attempts to remove them. The person should be placed before a strong light, the lids held open with one hand, or by another person, and the particles brushed away with the corner of a fine linen or silk handkerchief.

447. Sometimes the substance is concealed under the upper eyelid, and it may then be exposed by turning back the lid in the following manner: Take a knitting-needle, or small slender piece of stick which is perfectly smooth, and place it over the upper lid, in contact with and just under the edge of the orbit; then, holding it firmly, seize the lashes with the fingers of the disengaged hand, and gently turn the lid back over the stick or needle. You can then examine the inner side of the lid, and remove any substance that may have been there concealed. Too many trials ought not to be made, if unsuccessful, as much inflammation may be induced; but a surgeon, in such cases, ought to be consulted as soon as possible.

448. Eye-stones ought never to be placed in the eye, as they often cause more pain and irritation than the evil which they are intended to remedy.

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446. How can dust and other small particles be removed from the eye? 447. How removed from the upper eyelid? 448. Ought eye-stones to be used?

CHAPTER XIII

ABSORPTION.

449. "By Absorption is meant the removal of the soft or hard parts of the body, or of substances placed in contact with these parts."

Illustration. When emaciation takes place in consumption, or when the fluid in the limbs of a dropsical person has disappeared, the fat and the fluid are said to have been absorbed.

450. Absorption is of two kinds. 1st. The process by which food and drink are removed from the stomach and intestines, and conveyed into the system, for its growth and nourishment.

451. 2d. The action of the absorbent vessels and glands, and also the small veins, by which the waste material from the different organs is poured into the circulating torrent and carried out of the body.

452. The absorbent vessels are very minute at their commencement; so much so, that they cannot be seen without the aid of a magnifying glass. These small ducts unite and form larger trunks, that open into the veins.

453. They are found in every part of the body, except the brain. The knotted appearance of these vessels is owing to the arrangement of their internal coats, to form valves.

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449. What is meant by *absorption?* Give an illustration. 450. How many kinds of absorption? Give the 1st. 451. Give the 2d. 452. What is said of the size of the absorbent vessels? 453. Where are they found?

Fig. 82.

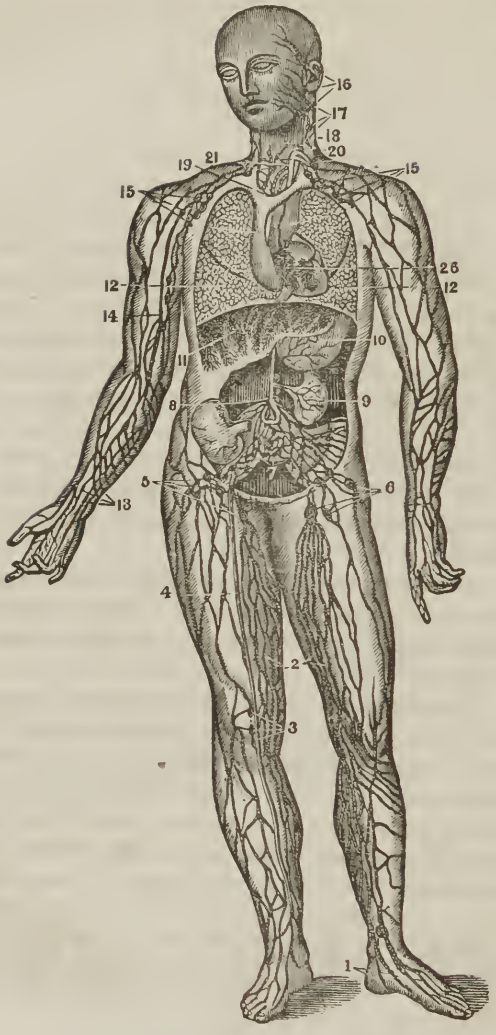

Fig. 82. A representation of the absorbent vessels and glands. 1, 2, 3, 4, 5, 6, The absorbent vessels and glands of the lower limbs. 7, Lymphatic glands. 8, The commencement of the thoracic duct. 9, The absorbents of the kidney. 10, Of the stomach. 11, Of the liver. 12, 12, The lungs. 13, 14, 15, The absorbents and glands of the arm. 16, 17, 18, Of the face and neck. 19, 20, Large veins. 21, The thoracic duct. 26, The absorbents of the heart.

454. In certain parts of the body, as the neck, these vessels pass through small, soft bodies, called *lym-phat'ic* glands.

Observation. Sometimes, when we are afflicted with a cold, these glands in the neck enlarge; they are usually called "kernels."

455. When little or no food is taken into the stomach, life is sustained by the absorbent vessels, which imbibe, or suck up, particles of fat, and convey them into the veins. It is the removal of the fat that causes the lean appearance of a person recovering from sickness. In consumption, not only the fat, but more solid parts of the body, are removed by absorption.

456. Bears and other animals, that live in a half-torpid state during the winter, derive their nourishment from the same source.

457. The most important absorbing surfaces are the stomach, intestines, lungs, and skin. Through the lungs absorption is not only very great, but extremely rapid.

Illustrations. 1st. In inhaling sulphuric ether, or letheon, it is introduced into the vessels of the lungs in the form of vapor, and through them it is rapidly conveyed to the brain, and thus influences the nervous system.

2d. Tobacco in a state of minute division, as the smoke of a cigar or pipe, is carried into the system by the action of the absorbent vessels of the lungs. This is the reason

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What does fig. 82 represent? 454. What are lymphatic glands? Are these glands ever seen? 455. How is life sustained when we cannot take food? 456. What sustains those animals that live in a half-torpid state during the winter? 457. Name the most important absorbing surfaces. What is said of the absorbing power of the lungs? Give illustration 1st. Illustration 2d.

that persons unaccustomed to the smoke of tobacco are nauseated by it. It is a violation of the rights of others to contaminate or fill the air (which is common property) of public rooms and conveyances, and also the streets, by puffing cigars in them.

458. It is probable, also, that the poisonous vegetable or animal matter which produces fever and other diseases, is in this way introduced into the body.

459. This affords another reason why the rooms of sick persons should be kept clean and well ventilated. As a general rule, no person should attend another that is sick more than twelve hours at a time.

SECRETION.

460. To *secrete* means to *separate*. The curious and mysterious operation of secretion is performed by the capillary vessels.

461. The material that forms the bones, muscles, skin, &c., is deposited in the appropriate places by these minute vessels. This may be called *nutritive* secretion.

Fig. 83.

Fig. 83. A secretory follicle. An artery is seen, which supplies the material for its secretion. Follicles are also supplied with veins and organic nerves.

462. The fluids that aid in the digestion of food, as the saliva, gastric juice, bile, pancreatic juice, and synovia, are all the result of secretion.

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458. How is it probable that diseases are contracted? 459. How long should a person attend another that is sick? 460. What is the meaning of *secrete*? How is the operation of secretion performed? 461. Define *nutritive* secretion. What does fig. 83 represent? 462. Name some fluids that are the result of secretion.

463. The fluids that carry the waste, useless matter from the system, as the perspiration and product of the kidneys, are examples of another result of secretion.

464. Another kind of secretion is performed by small pouches, called *Fol'li-cles*. The slimy fluid that they secrete is thrown upon the surface of membranes, by minute openings. The mucus of the lips, windpipe, and bronchial tubes affords examples of this kind of secretion.

465. The blood contains all the materials of secretion. The different appearances in the secretory fluids, as the yellow, ropy bile, the briny tear, and the tasteless saliva, are chiefly owing to the action of small bodies, called *glands*.

466. Glands are formed of minute arteries, veins, and tubes, wound together. They vary in size from a mustard seed to that of the liver, which weighs from two to four pounds.

Fig. 84.

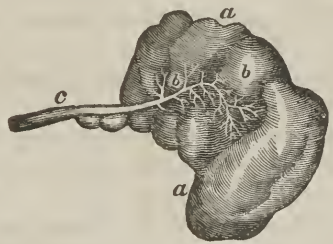

Fig. 84. *a*, *a*, Secretory gland. *b*, *b*, Minute ducts that are spread through the glands. These unite to form the main duct, *c*.

467. Every gland, however minute, has a small duct for collecting and carrying off the secreted fluid.

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463. Is perspiration a product of secretion? 464. What small bodies secrete mucus? 465. From what are all the different secretions formed? What causes the difference in the appearances of the secretions? 466. Describe glands. 467. Do the smallest glands have ducts?

468. The secretions are much influenced by mental emotions. If we smell savory food, there will be an increased flow of saliva in the mouth; if we hear the intelligence of the death of a cherished friend, the tear will quickly course down the cheek.

469. Unless the secretions are regularly maintained, disease will be the final result. Let the secretions from the skin be suppressed, and fever or some internal disease will be produced. If the bile be impeded, digestion will be impaired. If other secretions be suppressed, it will cause a derangement in the functions of the various internal organs.

ANIMAL HEAT.

470. Various opinions exist among physiologists in regard to the manner in which the warmth of the system is maintained. Observation and experiment show that heat is produced by an action among the particles of matter in the body.

471. In breathing, carbon passes from the body, and oxygen is received. This change of matter is attended by a change of temperature. In nutrition, fluids are converted into solids; in absorption, solids are changed into fluids; in secretion, old particles of matter are removed from the blood, and new particles are formed; in digestion, food is changed into chyle. In all these processes, heat is produced.

472. All of these changes are effected in the capillary vessels, and all require a certain amount of pure blood and nervous fluid. It may be concluded, then, that respiration, circulation, and nervous influence, all coöperate in producing animal heat, or that they are conditions essential to this phenomenon.

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468. Are the secretions influenced by mental emotions? 469. What is the effect if secretions be obstructed? 470. Are the sources of animal heat well understood? What do observation and experiment show? 471. Name the different processes of the system which produce animal heat. 472. Where are all of these changes effected? What functions coöperate in the production of animal heat?

CHAPTER XIV.

MEANS OF PRESERVING THE HEALTH.

473. Our bodies are constituted according to certain laws, and every person should learn these laws, in order to regulate his actions and duties, so that life may be prolonged, and the power of enjoyment, activity, and usefulness, continue while life lasts.

474. It is a law of the muscles, that they should either be used in some vocation, or called into action by some social play and active sport. (As to the proper time for calling the muscles into action, see Practical Suggestions, Chap. IV.)

475. All admit that food is necessary to sustain life; and unless it be of a proper quality, taken in proper quantities, and at proper times, the functions of the digestive organs will be deranged, and disease produced. (See Practical Suggestions, Chap. VI.)

476. Pure air is essential to the full enjoyment of health. The close, impure air of heated rooms and crowded assemblies may be breathed, and the effect be so gradual as not to arrest attention; yet it is a violation of the physical laws, and, sooner or later, we pay the penalty in disease and suffering. (See Practical Suggestions, Chap. VIII.)

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473. Why is it incumbent on every person to learn the laws of health? 474. Give a law of the muscles. 475. In preserving the health, is it necessary to give attention to the food which is eaten? Why? 476. What beside food is essential to the full enjoyment of health? What is said of the impure air of heated rooms and crowded assemblies?

477. The body also requires sleep; and if it is not taken at the right time, we do not feel a full refreshment from "tired nature's sweet restorer." Let youth be taught that "early to bed and early to rise" gives him health and its attendant blessings. The brain, like other organs of the body, should be called into action at proper times. (See Practical Suggestions, Chap. X.)

478. In preserving the health, it is very important that the functions of the skin be not deranged; and usually no part of the body is so much neglected. (For the means by which it may be kept in a healthy state, see Practical Suggestions, Chap. XI.)

REMOVAL OF DISEASE.

479. It is seldom that a physician is called in the first stages of disease. At this important period, the treatment adopted should be proper and judicious, or the sufferings of the patient are increased, and life, to a greater or less degree, is jeopardized. Hence the utility of knowing what *should be done*, and what *should not be done*, in order that the health may be rapidly regained.

480. In all instances of acute disease, it is proper to *rest*, not only the body, but the mind. To effect this, the patient should cease from muscular exertion, and also withdraw his thoughts from study and business operations. This should be done, even if the person is but slightly indisposed.

481. A sick person, whether a child or an adult, should not be disturbed by visitors, even if their calls are short. The excitement of meeting them is followed by a depression

477. Should regularity be observed in regard to sleep? 478. Have the functions of the skin great influence in keeping other organs healthy? 479. What is important in the first stages of disease? 480. What is proper in all instances of acute disease? How can it be effected? 481. What effects have calls, though they be short, on the sick?

of the nervous system. The more dangerous and apparently nearer death the sick person is, the more rigorous should be the observance of this suggestion.

482. The custom of visiting and conversing with sick friends during the intervals of daily labor, and particularly on *Sunday*, is a great evil. No person will be guilty of this, who cares more for the welfare of the suffering friend than the gratification of a *sympathetic curiosity*.

Illustration. While attending a Miss B., of N. H., sick of fever, I pronounced her better, withdrew medicine, directed a simple, low diet, and the exclusion of all visitors. In the evening, I was sent for, in haste, to attend her. There was a violent relapse of the disease, which continued to increase in severity until the fourth day, when death terminated her sufferings. I learned that, soon after I gave directions that no visitors be admitted into her room, several *particular* friends were permitted to enter the chamber and talk with the sick girl. Their conversation produced a severe headache, and, to use the language of the patient, "it seemed as if their talk would kill me;" and *it did kill her.*

483. No *solid food* should be taken in the first stages of disease, even if the affection is slight. The thirst can be allayed by drinking cold water, barley-water, and other preparations of this simple character.

484. When a patient is recovering from illness, the food should be simple in quality, and in quantities not so great as to oppress the stomach. It should also be given with regularity. "Eat little and often," with no regard to regularity, is a pernicious practice.

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482. What is said of the custom of calling and conversing with the sick during the intervals of daily labor? Give an illustration. 483. Should solid food be taken in the first stages of disease? How can the thirst be allayed? 484. When the patient is convalescent, how should the food be given? What is said of the practice of eating "little and often"?

485. In all instances, when a physician attends a sick person, he should have the *special* management of the food, particularly after the medicine has been withdrawn and the patient is convalescent. The prevailing idea that *every* person may safely advise relative to food, or that the appetite of the convalescing person will guide correctly, is dangerous, and cannot be too much censured.

Illustration. In 1832, I attended a Miss H., sick of fever. After an illness of a few days, the fever abated, and I directed a simple, unstimulating diet. Business called me from the town two days. During my absence, a sympathizing, officious matron called; found her weak, but improving; and told her she needed food to strengthen her; that "food was made to eat," and "it would now do her good." Accordingly, wine and eggs, with a piece of beefsteak, were prepared, and given to the convalescent girl. She ate heartily, and the result was a relapse of the fever. For several days, her friends watched by her bedside, expecting every hour would be her last. She recovered, and her sufferings taught that matron a lesson that was not soon forgotten.

486. It is very important in disease that the skin be *kept clean.* A free action of the vessels of this part of the body exerts a great influence in removing disease from the internal organs, as well as keeping them in health. If the twenty or thirty ounces of waste, hurtful matter, that passes through the "pores" of the skin in twenty-four hours, is not removed by frequent bathing and dry rubbing, it deranges the action of the vessels that separate this waste matter from the blood, and thus increases the disease of the internal organs.

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485. Who should have the special management of food when medicine is withdrawn? What idea prevails in the community? Give an illustration of the evil effects attending such an idea. 486. Does the skin exert a great influence in removing disease from the internal organs, as well as in keeping them in health?

487. Every sick person should breathe *pure air*. The purer the blood that courses through the body, the greater the energy of the system to remove disease. The confined, vitiated air of the sick-chamber not unfrequently prolongs disease, and, in many instances, the affection is not only aggravated, but even rendered fatal, by its injurious influences.

Illustration. 1st. In 1833, I was called, in consultation with another physician, to Mr. H., who was much debilitated from a long sickness, and was delirious. For several successive days he had not slept. His room was kept very warm and close, for fear he would "take cold." The only change that I made in the treatment was to open the door and window, at a distance from the bed. In a short time, the delirium ceased, and he fell into a quiet slumber. From this time he rapidly recovered, and I have no doubt that the delirium was the result of breathing impure air.

2d. Formerly, every precaution was used to prevent persons sick of the small-pox from breathing fresh air. When Mrs. Ramsay had this disease in Charleston, S. C., her friends, supposing that life was extinct, caused her body to be removed from the house to an open shed. The pure air revived the vital spark. The result probably would have been different, had she been kept a few hours longer in the confined, vitiated air.

488. MEDICINE is sometimes necessary to *assist* the natural powers of the system to remove disease; but it is only an *assistant*. While emetics are occasionally useful in removing food and other articles from the stomach, that would cause disease if suffered to remain, and cathartics are valuable, in some instances, to relieve the intestines of irri-

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487. Why should every sick person, particularly, breathe pure air? Are not diseases prolonged, and even rendered fatal, from breathing the impure, vitiated air of the sick-chamber? Give illustration 1st. Give illustration 2d. 488. What is said of the use of medicine?

tating residuum, yet the frequent administration of either will cause serious disease. The same remarks may be made relative to the use of opium, to relieve pain, and of stimulating bitters, to create appetite.

489. Although medicine is useful in some instances, yet, in a great proportion of the cases of disease, including fevers and inflammations of all kinds, attention to the laws of health will tend to relieve the system from disease, more certainly and speedily, and with less danger, than when medicines are administered.

490. Thomas Jefferson, in writing to Dr. Wistar, of Philadelphia, said, "I would have the physician learn the limit of his art." I would say, Have the matrons, and those who are continually advising "herb teas, pills, powders, bitters," and other "cure-alls," for any complaint, labelled with some popular name, learn the limits of their duty, namely, attention to the laws of health. Future generations will look upon the administration of medicine, as now pursued, with as much astonishment and regret, as we view the habitual use of intoxicating drinks. The rule of every family, and each individual, should be, to touch not, taste not, of medicine of *any kind*, except when directed by a well-educated and honest physician, (sudden disease from accidents excepted.)

DIRECTIONS FOR NURSES.

491. The nurse requires knowledge and practice to enable her to discharge aright her duty to the patient, as much as the physician and surgeon do to perform what is incumbent on them.

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489. What is said of its use in fevers and many other cases of disease? 490. What remark by Thomas Jefferson to Dr. Wistar? What should matrons learn? What should be the rule of every person in regard to taking medicine? What exception? 491. Does the nurse require knowledge and practice in her employment, as well as the physician?

492. Woman, from her constitution and habits, is the natural nurse of the sick; and, in general, no small portion of her time is spent in ministering at the couch of disease and suffering. As the young and vigorous, as well as the aged and the infirm, are liable to be laid upon the bed of sickness, by an epidemic, or imprudent exposure, or by some accident, it is therefore necessary that the girl, as well as the matron, may know how she can render services in an efficient and proper manner. No *girl* should consider her education complete who is not acquainted with the principles of the duties of a general nurse and a temporary watcher.

493. It is to be regretted, that, while we have medical schools and colleges to educate physicians, there is no institution to educate *nurses* in their equally responsible station. In the absence of such institutions, the defect can be remedied, to some extent, by teaching every girl *practical physiology* or *the laws of health*. To make such knowledge more available and complete, attention is invited to the following suggestions relative to the practical duties of a nurse.

494. Bathing. The nurse, before commencing to bathe the patient, should provide herself with water, two towels, a sponge, a piece of soft flannel, and a sheet.

495. When the patient is feeble, use *tepid* or warm water. Cold water should only be used when the system has vigor enough to produce reaction upon the skin. This is shown by the increased redness of the skin and a feeling of warmth and comfort.

496. Before using the sponge to bathe, a sheet, or fold of cloth, should be spread smoothly over the bed, and under

492. Who is the natural nurse of the sick? What, then, is incumbent on every girl? 493. Should there be schools to educate nurses, as well as physicians and surgeons? 494. What should the nurse provide herself with, before bathing a patient? 495. When should cold water be used? 496. How should the bathing then be performed so that the patient may not contract a cold?

the patient, to prevent the bed-linen on which the patient lies from becoming damp or wet. Apply the wet sponge to one part of the body at a time, as the arm, for instance. By doing so, the liability of contracting chills is diminished. Take a dry towel, wipe the bathed part, and follow this by vigorous rubbing with a crash towel, or, what is better, a mitten made of this material; then use briskly a piece of soft flannel, to remove all moisture that may exist on the skin, and particularly between the fingers and the flexions of the joints. In this manner, bathe the entire body.

497. The sick should be thoroughly bathed at least twice in twenty-four hours. The practice of daubing the face and hands with a rag dipped in hot rum, camphor, and vinegar, does not remove the impurities, but causes the skin soon to feel dry, hard, and uncomfortable. The best time for bathing is when the patient feels the most vigorous and freest from exhaustion.

498. Food. It is the duty of every woman to know how to make the simple preparations adapted to a low diet in the most wholesome and the most palatable way. Water-gruel,* which is the simplest of all preparations, is frequently so ill made as to cause the patient to loathe it.

499. When the physician enjoins abstinence from food, the nurse should strictly obey the injunction. She should be as particular in getting the physician's directions about diet, as in knowing how and when to give the prescribed medicines, and abide by them as faithfully.

* Directions for making the simple preparations for the sick are found in almost every cook-book.

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497. How often should a sick person be bathed? What is said of daubing the face and hands merely with a wet cloth? 498. Should every woman know how to make the simple preparations adapted to a low diet? 499. Should the nurse strictly obey the injunctions of the physician relative to food?

500. When a patient is convalescent, it often requires firmness and great care, on the part of the nurse, that the food is prepared suitably, and given at proper times. The physician should direct how frequently it should be taken.

501. PURE AIR. It is the duty of the nurse to see that not only the room is well ventilated in the morning, but that fresh air is constantly coming in during the day. Great care must be taken, however, that the patient does not feel the current.

502. Bed-linen, as well as that of the body, should be aired every day, and oftener changed in sickness than in health. All clothing, when changed, should be well dried, and warmed by a fire previous to its being put on the patient or the bed.

503. There should be a well-adjusted thermometer in every sick-room. The feelings of the nurse or patient are not to be relied on as an index of the temperature of the room.

504. The temperature of the sick-chamber should be *moderate*. If it is so cold as to cause a chill, the disease will be aggravated. If, on the other hand, it is too warm, the patient is enfeebled and rendered more susceptible to cold, on leaving the sick-chamber. The Latin maxim "*In medio tutissimus ibis*," (in medium there is most safety,) should be regarded in the rooms of the sick.

505. The room of the patient should be kept QUIET. It is the imperative duty of the physician to direct that all visitors be excluded, and no more persons remain in the room

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500. What period of a person's illness requires the most care in regard to the food? 501. Give another duty of the nurse. 502. What directions respecting the bed-linen of the patient? What is necessary when there is a change of clothing? 503. Why should there be a well-adjusted thermometer in every sick-chamber? 504. What is said of the temperature of the sick-chamber? 505. Should the sick-room be kept quiet?

than the welfare of the patient demands. The duty of the nurse is, to see that these directions are enforced.

506. The movements of the attendants should be gentle and noiseless. Shutting doors violently, creaking hinges, and all unnecessary noise, should be avoided. Most persons refrain from loud talking in the sick-chamber, but are not equally careful to abstain from *whispering*, which is often more trying than a common tone.

507. The deportment and remarks of the nurse to the patient should be tranquil and encouraging. No doubts or fears of the patient's recovery, either by a look or by a word, should be communicated by the nurse in the chamber of the sick.

508. When such information is necessary to be communicated, it is the trying duty of the physician to impart it to the sick person.

509. The nurse should not confine herself to the sick-room more than six hours at a time. She should eat her food regularly, sleep at regular periods, and take exercise daily in the open air. To do this, let her quietly leave the room when the patient is sleeping. A watcher, or temporary nurse, may supply her place.

DIRECTIONS FOR WATCHERS.

510. These necessary assistants, like the nurse, should have knowledge and practice. They should ever be cheerful, kind, firm, and attentive in the presence of the patient.

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506. What is said of noise in the sick-chamber? Of whispering? 507. What should be the deportment of the nurse towards the patient? Should doubts and fears of the patient's recovery be communicated in the sick-room? 508. When necessary to communicate such intelligence, on whom does it depend? 509. How long should a nurse remain in the sick-chamber at a time? 510. What qualifications are necessary in a watcher?

511. A simple, nutritious supper should be eaten before entering the sick-room; and it is well, during the night, to take some plain food.

512. When watching in cold weather, take care to be warmly dressed, and furnished with an extra garment, as a cloak or shawl, as you may be chilly before morning.

513. It can hardly be expected that the farmer, who has been laboring hard in the field, or the mechanic, who has toiled during the day, is qualified to render all those little attentions that a sick person requires. Hence, would it not be more benevolent and economical to employ and *pay* watchers, who are qualified by knowledge and *training*, to perform this duty in a faithful manner, while the kindness and sympathy of friends may be *practically* manifested by assisting to defray the expenses of these qualified and useful assistants?

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511. What directions in regard to the food of the watcher? 512. When watching in cold weather, what precaution is necessary? 513. What is said of employing those persons to watch who labor hard during the day?

APPENDIX.

POISONS AND THEIR ANTIDOTES.

514. Poisoning, either from accident or design, is of such frequency and danger, that it is of the greatest importance that every person should know the proper mode of procedure in such cases, in order to render immediate assistance when within his power.

515. Poisons are divided into two classes — *mineral* (which will include the acids) and *vegetable*.

516. The first thing, usually, to be done, when it is ascertained that a poison has been swallowed, is to evacuate the stomach, unless vomiting takes place spontaneously. Emetics of the sulphate of zinc, (white vitriol,) or ipecacuanha, (ipecac,) or the wine of antimony, should be given.

517. When vomiting has commenced, it should be aided by large and frequent draughts of the following drinks: flaxseed tea, gum-water, slippery-elm tea, barley-water, sugar and water, or any thing of a mucilaginous or diluent character.

MINERAL POISONS.

518. Ammonia. — The *water of ammonia*, if taken in an over-dose, and in an undiluted state, acts as a violent corrosive poison.

519. The best and most effectual antidote is *vinegar*. It should be administered in water, without delay. It neutralizes the ammonia, and renders it inactive. Emetics should not be given.

520. Antimony. — The *wine of antimony* and *tartar emetic*, if taken in over-doses, cause distressing vomiting. In addition to the diluent, mucilaginous drinks, give a tea-spoonful of the sirup of poppies, paregoric, or twenty drops of laudanum, every twenty minutes, until five or six doses have been taken, or the vomiting ceases.

521. The antidotes are *nut-galls* and *oak bark*, which may be administered in infusion.

522. Arsenic. — When this has been taken, administer an emetic of ipecac, speedily, in mucilaginous teas, and use the stomach-pump as soon as possible.

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514. Is it useful to know the antidotes or remedies for poison? 515. Into how many classes are poisons divided? 516. What is the first thing to be done when it is ascertained that poison has been swallowed? 517. What should be taken after the vomiting has commenced? 518. What effect has an over-dose of ammonia? 519. The antidote? Should an emetic be given for this poison? 520. What effect has an over-dose of the wine of antimony or tartar emetic? 521. What is the antidote? 522. What should immediately be done when arsenic is swallowed?

523. The antidote is the *hydrated peroxide of iron.* It should be kept constantly on hand at the apothecaries' shops. It may be given in any quantity, without injurious results.

524. COPPER. — The most common cause of poisoning from this metal, is through the careless use of cooking utensils made of it, on which the *acetate of copper* (verdigris) has been allowed to form. When this has been taken, immediately induce vomiting, give mucilaginous drinks, or, what is still better, the *white of eggs*, diffused in water.

525. The antidote is the *carbonate of soda*, which should be administered without delay.

526. LEAD. — The *acetate* (sugar) *of lead* is the preparation of this metal which is liable to be taken accidentally, in poisonous doses. Induce immediate vomiting, by emetics and diluent drinks.

527. The antidote is diluted *sulphuric acid.* When this acid is not to be obtained, either the sulphate of magnesia, (epsom salts,) or the sulphate of soda, (glauber's salts,) will answer every purpose.

528. MERCURY. — The preparation of this mineral by which poisoning is commonly produced, is *corrosive sublimate.* The mode of treatment to be pursued, when this poison has been swallowed, is as follows: The *whites of a dozen eggs* should be beaten in two quarts of cold water, and a tumbler-ful given every two minutes, to induce vomiting. When the whites of eggs are not to be obtained, soap and water should be mixed with wheat flour, and given in copious draughts, and the stomach-pump introduced as soon as possible. Emetics or irritating substances ought not to be given.

529. NITRE — *Saltpetre.* This, in over-doses, produces violent poisonous symptoms. Vomiting should be immediately induced by large doses of mucilaginous, diluent drinks; but emetics, which irritate the stomach, ought not to be given.

530. ZINC. — Poisoning is sometimes caused by the *sulphate of zinc*, (white vitriol.) When this takes place, vomiting should be induced, and aided by large draughts of mucilaginous and diluent drinks. Use the stomach-pump as soon as possible.

531. The antidote is the *carbonate* or *super-carbonate of soda.*

532. NITRIC, (aqua fortis,) MURIATIC, (marine acid,) or SULPHURIC, (oil of vitriol,) ACIDS, may be taken by accident, and produce poisonous effects.

533. The antidote is *calcined magnesia*, which should be freely administered, to neutralize the acid and induce vomiting. When magnesia cannot be obtained, the *carbonate of potash* (salæratus) may be given. *Chalk*, powdered and given in solution, or strong *soap suds*, will answer a good purpose, when the other articles are not at

523. What is the antidote? Can any quantity of this preparation of iron be given without injurious results? 524. What should be given when verdigris has been taken into the stomach? 525. What is the antidote? 526. What should immediately be given when sugar of lead is taken? 527. What is the antidote? 528. Give the treatment when corrosive sublimate has been swallowed. 529. What effect has an over-dose of saltpetre? What treatment should be adopted? 530. What is the antidote for white vitriol? 533. What is the antidote for aqua fortis and oil of vitriol?

hand. It is of very great importance that something be given speedily, to neutralize the acid. One of the substances before named should be taken freely, in diluent and mucilaginous drinks; as gum-water, milk, flaxseed or slippery-elm tea. Emetics ought to be avoided.

534. Oxalic Acid. — This acid resembles the sulphate of magnesia, (epsom salts,) which renders it liable to be taken, by mistake, in poisonous doses. Many accidents have occurred from this circumstance. They can easily be distinguished by tasting a small quantity. *Epsom salts*, when applied to the tongue, have a very bitter taste, while *oxalic acid* is intensely sour.

535. The antidote is *magnesia*, between which and the acid a chemical action takes place, producing the oxalate of magnesia, which is inert. When magnesia is not at hand, *chalk*, *lime*, or *carbonate of potash*, (salæratus,) will answer as a substitute.

536. Give the antidote in some of the mucilaginous drinks before named. No time ought to be lost, but the stomach-pump should be introduced as soon as a surgeon can be obtained.

537. Ley. — The ley obtained by the leaching of ashes may be taken by a child accidentally. The antidote is vinegar, or oil of any kind. The vinegar neutralizes the alkali by uniting with it, forming the acetate of potash. The oil unites with the alkali, and forms soap, which is less caustic than the ley. Give, at the same time, large draughts of mucilaginous drinks, as flaxseed tea, &c.

VEGETABLE POISONS.

538. The vegetable poisons are quite as numerous, and many of them equally as violent, as any in the mineral kingdom. We shall describe the most common, and which, therefore, are most liable to be taken.

539. Opium. — This is the article most frequently resorted to by those wishing to commit suicide, and, being used as a common medicine, is easily obtained. From this cause, also, mistakes are very liable to be made, and accidents result from it. Two of its preparations, *laudanum* and *paregoric*, are frequently mistaken for each other; the former being given when the latter is intended.

540. *Morphia*, in solution, or *morphine*, as it is more commonly called by the public, is a preparation of the drug under consideration, with which many cases of poisoning are produced. It is the active narcotic principle of the opium; and one grain is equal to six of this drug in its usual form.

541. When an over-dose of opium, or any of its preparations, has been swallowed, the stomach should be evacuated as speedily as possible. To effect this, as much tartar emetic as can be held on a ten-cent

Should emetics be avoided? 534. How can oxalic acid be distinguished from epsom salts? 535. What is the antidote for an over-dose of oxalic acid? When magnesia cannot be obtained, what will answer as a substitute? 537. What is the antidote when ley is swallowed? 538. Are vegetable poisons as numerous and as violent in their effects as mineral? 539. What is said of opium and its preparations? 541. What treatment should be adopted when an over-dose of opium or any of its preparations is taken?

piece, or as much *ipccacuanha* as can be held on a twenty-five cent piece, should be dissolved in a tumbler of warm water, and one half given at once, and the remainder in twenty minutes, if the first has not, in the mean time, operated. In the interval, copious draughts of warm water, or warm sugar and water, should be drank.

542. The use of the stomach-pump, in these cases, is of the greatest importance, and should be resorted to without delay. After most of the poison has been evacuated from the stomach, a strong infusion of *coffee* ought to be given ; or some one of the vegetable acids, such as *vinegar* or *lemon-juice*, should be administered.

543. The patient should be kept in motion, and salutary effects will often be produced by dashing a bucket of cold water on the head. *Artificial respiration* ought to be established, and kept up for some time. If the extremities are cold, apply warmth and friction to them. After the poison has been evacuated from the stomach, stimulants, as warm wine and water, or warm brandy and water, ought to be given, to keep up and sustain vital action.

544. Stramonium — *Thorn-Apple.* This is one of the most active narcotic poisons, and when taken in over-doses, has, in numerous instances, caused death.

545. *The Treatment.* — Similar to that recommended in poisoning from opium.

546. Hyosciamus — *Henbane.* This article, which is used as a medicine, if taken in improper doses, acts as a virulent irritating and narcotic poison.

547. *Treatment.* — Similar to that of poisoning from over-doses of opium.

548. Conium — *Hemlock.* Hemlock, improperly called, by many, *cicuta*, when taken in an over-dose, acts as a narcotic poison. It was by this narcotic that the Athenians used to destroy the lives of individuals condemned to death by their laws. Socrates is said to have been put to death by this poison. When swallowed in over-doses, the treatment is similar to that of opium, stramonium, and henbane, when over-doses are taken.

549. Belladonna — *Deadly Nightshade.* Camphor. Aconite — *Monkshood, Wolfsbane.* Bryony — *Bryonia.* Digitalis — *Foxglove.* Dulcamara — *Bitter-sweet.* Gamboge. Lobelia — *Indian Tobacco.* Sanguinaria — *Blood-root.* Oil of Savin. Spigelia — *Pink-root.* Strychnine — *Nux vomica.* Tobacco. All of these, when taken in over-doses, are poisons of greater or less activity. The treatment of poisoning, by the use of any of these articles, is similar to that pursued in over-doses of opium. (See *Opium*, page 140.)

550. In *all* cases of poisoning, call a physician as soon as possible.

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543. Should the person be kept in motion? 544. What should be the treatment when an over-dose of stramonium is taken? 546. For henbane? 548. What name is sometimes improperly given to *conium*, or hemlock? How was this narcotic poison used by the Athenians? How are the effects of an over-dose counteracted? 549. What is the treatment when an over-dose of deadly nightshade, monkshood, foxglove, bitter-sweet, gamboge, lobelia, blood-root, tobacco, &c., is taken? 550. Should a physician be called in all cases when poison is swallowed?

GLOSSARY.

AB-SORP'TION. From the Latin *absorbere*, to suck up. The use of the absorbent vessels is to take up substances from without or within the body.

AC-E-TAB'U-LUM. From the Latin *acetum*, vinegar. The cavity in the hip-bone, so called from its resemblance to the ancient Greek vinegar vessel.

A-NAT'O-MY. From the Greek *ana*, through, and *temnô*, I cut. A description of the structure of animals.

A-OR'TA. From the Greek *aorte*, to keep in air. The large vessel that carries blood from the heart.

AP-PA-RA'TUS. From the Latin *ad*, for, and *parare*, to prepare. A collection of organs.

AP-PEN'DIX. From the Latin *ad*, to, and *pendere*, to hang. Something added.

A-RACH'NOID. From the Greek *arachne*, a spider's web, and *eidos*, resemblance. A thin membrane that covers the brain.

AR'TE-RY. From the Greek *arteria*, formed from *aër*, air, and *terein*, to keep. The ancients believed that the arteries were filled with air, like the windpipe.

AT'MOS-PHERE. From the Greek *atmos*, vapor, and *sphaira*, a sphere. The air which surrounds the earth.

AU'DI-TO-RY. Belonging to the sense of hearing.

AU'RI-CLE. From the Latin *auris*, an ear. The two cavities of the heart derive the name from their resemblance to ears.

BI-CUS'PIDS. From the Latin *bis*, two, and *cuspis*, a point. The name of certain teeth.

BILE. A yellow, bitter, nauseous fluid, secreted by the liver.

BRON'CHUS, -CHI. From the Greek *bronchos*, the throat. The two branches of the windpipe.

BRON'CHI-AL. Relating to the bronchi.

CA-NINE'. From the Latin *canis*, a dog. The name of certain teeth.

CAP'IL-LA-RY. From the Latin *capillus*, hair. The capillary vessels are the extremely minute terminations of the arteries, and commencing branches of the veins.

CAR'BON. Pure charcoal.

CAR-BON'IC. Relating to carbon.

CAR'DI-A. From the Greek *kardia*, the heart. The opening of the stomach where the œsophagus enters.

CAR'PUS. From the Greek *karpos*, the wrist. There are eight bones in the wrist.

CAR'TI-LAGE. Gristle; a part of the animal body, softer than bone, but harder than ligament.

CER-E-BEL'LUM. The lower and smaller portion of the brain.

CER'E-BRUM. The upper and larger portion of the brain.

CHEST. The part of the body between the neck and the belly.

CHO'ROID. From the Greek *chorion*, the skin, and *eidos*, resemblance.

CHYLE. From the Greek *chulos*, nutritious juice.

CHYME. From the Greek *chumos*, a grayish juice.

CIL'I-A-RY. Latin. Relating to the eyelids.

CLAV'I-CLE. From the Latin *clavis*, a key. The collar-bone.

COC'CYX. Latin. The lower extremity of the spinal column.

COCH'LE-A. Latin. A snail-shell. A name given to one of the three cavities of the internal ear.

CO'LON. Greek. The first portion of the large intestines.

CON'CAVE. Hollow; as the inner surface of a spherical body.

CON'VEX. Bulging; as the external surface of a spherical body.

COR'NE-A. From the Latin *cornu*, a horn. One of the coats of the eye.

CU'TI-CLE. The external layer of the skin.

CU'TIS VE'RA. Latin. The true skin. The internal layer of the skin.

DI'A-PHRAGM. From the Greek *diaphragma*, a partition. The muscle that separates the lungs and heart from the stomach, liver, and intestines.

DI-GES'TION. The process of dissolving

food in the stomach, and preparing it for circulation and nourishment.

DU-O-DE'NUM. The first of the small intestines, being about twelve fingers' breadth.

DU'RA. Latin. Hard. A dense membrane which covers the brain.

EN-AM'EL. The smooth, hard substance which covers the crowns of the teeth.

EP-I-GLOT'TIS. From the Greek *epi*, upon, and *glottis*, the glottis. A kind of cartilaginous valve at the upper part of the larynx, behind the base of the tongue. It closes at the moment of swallowing, to prevent food and drink from passing into the windpipe.

EU-STA'CHI-AN TUBE. So called from its discoverer, *Eustachius*. A tube that connects the middle ear with the throat.

EX-HA'LENT. From the Latin *exhalare*, to throw out.

EX-TREM'I-TIES. The limbs; the legs and arms.

FE'MUR. Latin. The thigh-bone.

FI'BRE. An organic filament, or thread, of a solid consistence, which enters into the composition of every animal and vegetable texture.

FIB'U-LA. Latin. A clasp. The outer and lesser bone of the leg.

FOL'LI-CLE. From the Latin *follis*, a bag. Very minute secreting cavities.

FORE'ARM. That part of the arm between the elbow and wrist.

FUNC'TION. From the Latin *fungor*, I act, I perform. The action of organs; as the function or action of the eye is to see, the ear to hear.

GAS'TRIC JUICE. From the Greek *gaster*, the stomach. The fluid secreted by the stomach.

GEL'A-TIN. From the Latin *gelu*, jelly.

GLOT'TIS. A small, oblong opening at the upper part of the larynx.

HU'MER-US. The bone of the arm, situated between the shoulder-joint and elbow.

HU'MOR. Every fluid substance of an organized body; as the chyle, the blood.

IN-CI'SOR. From the Latin *incido*, I cut. The fore-teeth.

I'RIS. Latin. The rainbow. The colored membrane round the pupil of the eye.

LAB'Y-RINTH. From the Greek *laburinthos*, a place full of turnings. A name given to the windings of the internal ear.

LACH'RY-MAL. From the Latin *lachryma*, a tear.

LAC'TE-AL. From the Latin *lac*, milk. The vessels that convey the chyle, or a milk like substance, into the veins.

LAR'YNX. From the Greek *larugx*, a whistle. The upper part of the windpipe.

LIG'A-MENT. From *ligo*, I bind. A strong, fibrous substance, which binds bones, &c., together.

LOBE. A round, projecting part of an organ.

MAS'TI-CATE. To chew.

ME-DUL'LA SPI-NA'LIS. From the Latin *medulla*, marrow, and *spinalis*, relating to the spine. The spinal cord.

ME-DUL'LA OB-LON-GA'TA. The spinal cord that is situated within the skull-bones.

MEM'BRANE. From the Latin *membrana*, a film, a delicate web. A name given to different thin organs.

MES'EN-TER-Y. From the Greek *mesos*, in the middle, and *enteron*, an intestine. A membrane in the middle of the intestines, by which they are attached to the spinal column.

MET-A-CAR'PUS. From the Greek *meta*, after, and *karpos*, the wrist. That part of the hand between the wrist and fingers.

MET-A-TAR'SUS. From the Greek *meta*, after, and *tarsos*, the instep. That part of the foot between the instep and toes.

MID'RIFF. The diaphragm.

MO'LAR. From the Latin *molo*, I grind. The name of certain teeth.

MU'CUS. A viscid fluid secreted by the mucous membrane, which it serves to moisten, and also to defend.

MUS'CLE. A bundle of fibres enclosed in a sheath.

MUS'CU-LAR. Relating to the muscles.

NERVE. An organ of sensation and motion in animals.

NI'TRO-GEN. From the Greek *nitron*, nitre, and *gennaô*, I beget. One of the gases that compose atmospheric air.

NU-TRI'TION. The act or process of promoting the growth, or repairing the waste of the system.

Œ-SOPH'A-GUS. From the Greek *oiô*, I carry, and *phagô*, I eat. The tube that leads from the mouth to the stomach.

OL-FAC'TO-RY. From the Latin *olfactus*. Belonging to the sense of smell.

O-MEN'TUM. Latin. The caul, so called because the ancient priests prophesied from an inspection of this part of the body.

OR'GAN. From the Greek *organon*, an instrument. A part of the system destined to exercise some particular function.

OX'Y-GEN. From the Greek *oxus*, acid, and *geinomai*, I engender. A gas which constitutes about one fifth of our atmosphere.

PAN'CRE-AS. From the Greek *pan*, all, and *kreas*, flesh; that is, *quite fleshy*. A gland situated behind the stomach.

PAN-CRE-AT'IC. Relating to the pancreas.

PA-PIL'LA. From the Latin *papilla*, nip-

ple. Small, conical prominences seen on the tongue and skin.

PA-ROT'ID. From the Greek *para*, about, and *ous*, the ear. A gland situated under the ear.

PA-TEL'LA. From the Latin, *patina*, a dish. The kneepan.

PEL'VIS. Latin. A basin. The name of a bony structure at the lower part of the trunk.

PER-I-OS'TE-UM. From *peri*, about, and *os*, bone. The membrane or skin that surrounds the bones.

PER-SPI-RA'TION. The evacuation of the fluids of the body through the pores of the skin.

PHA-LAN'GES. From the Greek *phalagx*, a file of soldiers. The bones composing the fingers and toes.

PHA'RYNX. From the Greek *pharugx*, the pharynx. The swallow.

PHYS-I-OL'O-GY. From the Greek *phusis*, nature, and *logos*, a discourse. The science which treats of the functions of animals and vegetables.

PLEU'RA. Greek. The membrane that lines the chest and surrounds the lungs.

PUL'MO-NA-RY. Belonging to the lungs.

PY-LO'RUS. From the Greek *pule*, a gate, and *ouros*, a guardian. The orifice of the stomach, that connects with the duodenum.

RA'DI-US. Latin. A spoke. The small bone of the fore-arm.

REC'TUM. The lower and straight portion of the intestines.

RET'I-NA. From the Latin *rete*, a net. The net-like expansion of the optic nerve on the inner surface of the eye.

RE-SID'U-UM. Residue. The waste remains of the food.

RES-PI-RA'TION. The act of breathing.

SA'CRUM. A bone so called because it was offered in sacrifice. The lower portion of the spinal column.

SA-LI'VA. Latin. The fluid secreted in the mouth.

SAL'I-VA-RY. Belonging or relating to saliva.

SCAP'U-LA. Latin. The shoulder-blade.

SCLE-ROT'IC. From the Greek *skleroo*, I harden. A membrane of the eye.

SE-CRE'TION. From the Latin *secernere*, to separate. The function of several glands, by which they separate from the blood the material which they respectively demand for their several purposes.

SKEL'E-TON. From the Greek *skellô*, I dry. The articulated, dry bones of an animal.

SPI'NAL CORD. A prolongation of the brain.

SPINE. From the Latin *spina*, a thorn. The back-bone.

SPLEEN. The milt. It was supposed by the ancients to be the seat of melancholy, anger, and vexation.

SUB-LIN'GUAL. From the Latin *sub*, under, and *lingua*, the tongue. The name applied to the gland under the tongue.

SUB-MAX'IL-LA-RY. From the Latin *sub*, under, and *maxilla*, the jaw-bone. The name applied to the gland under the jaw.

SU'TURE. From the Latin *suo*, I stitch. The seam or joint which unites the skull-bones.

SY-NO'VI-A. From the Greek *sun*, with, and *ôon*, an egg. The lubricating fluid of the joints.

SYS'TEM. From the Greek *sun*, together, and *istemi*, I place. An assemblage of organs, composed of the same tissues, and intended for the same functions.

SYS-TEM'IC. Belonging to the general system.

TAR'SUS. From the Greek *tarsos*, any row. The space between the bone of the leg and the metatarsus.

TEN'DON. From the Greek *teinô*, I stretch. Strong, white cords that connect the muscles to the bone which they move.

THO-RAC'IC. From the Greek *thôrax*, the chest.

TIB'I-A. Latin. A pipe or flute. The largest bone of the leg.

TRA'CHE-A. From the Greek *trachus*, rough, and *arteria*. The canal that conveys air to the lungs.

TRUNK. The body of animals, without the limbs.

TYM'PA-NUM. Latin. The drum of the ear.

UL'NA. Latin. A cubit. A bone of the fore-arm.

VALVE. From the Latin *valvæ*, a small door. Any membrane, or doubling of any membrane, which prevents fluid from flowing back in the vessels and canals of the animal body.

VEINS. From the Latin *vena*. The vessels that carry the blood to the heart.

VEN'TRI-CLE. Latin. A small cavity of the animal body.

VER'TE-BRA, -Æ. From the Latin *verto*, I turn. A joint of the spinal column.

VI'RUS. Latin. Poison.

VI'TAL. From the Latin *vita*, life.

VIT'RE-OUS. Pertaining to glass. A name given to one of the humors of the eye.